SOILS REPORT No. 12 1961

Report of

DETAILED-RECONNAISSANCE SOIL SURVEY

of

FISHER AND TEULON MAP SHEET AREAS

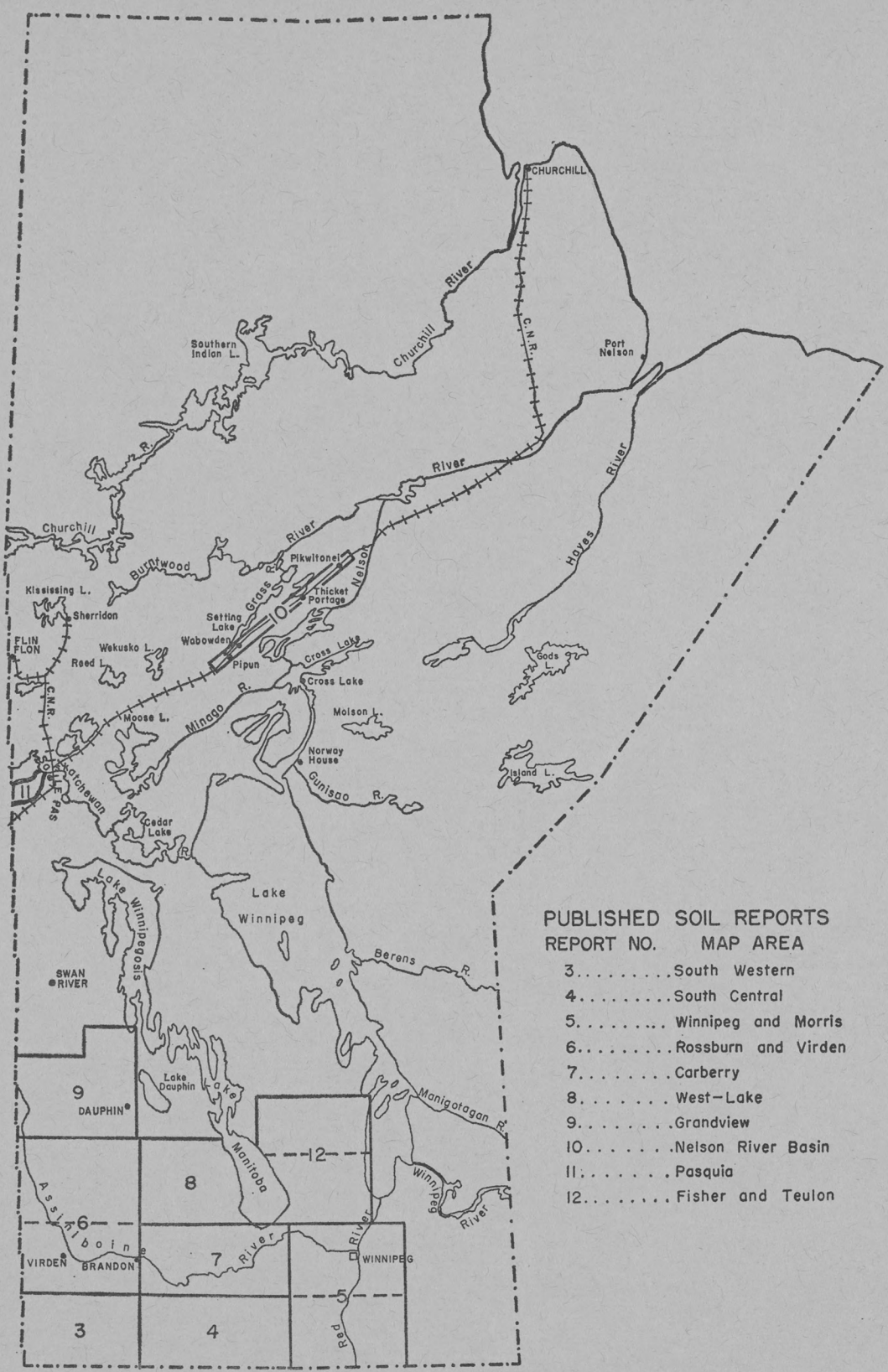
By
L. E. PRATT, W. A. EHRLICH
F. P. LECLAIRE AND J. A. BARR

With two Soil Maps, one covering Townships 21 to 25 in Ranges 7 west to 4 east of the Principal Meridian, designated as the "Fisher Map Sheet Area," and one covering Townships 15 to 20 in Ranges 7 west to 5 east of the Principal Meridian designated as the "Teulon Map Sheet Area," prepared by the Manitoba Soil Survey.

MANITOBA SOIL SURVEY

CANADA DEPARTMENT *of* AGRICULTURE,
MANITOBA DEPARTMENT *of* AGRICULTURE AND CONSERVATION,
LANDS BRANCH, MANITOBA DEPARTMENT *of* MINES AND NATURAL RESOURCES,
AND
DEPARTMENT OF SOIL SCIENCE, THE UNIVERSITY OF MANITOBA.

Report published by the Manitoba Department of Agriculture and Conservation.
Maps published by the Canada Department of Agriculture.



PUBLISHED SOIL REPORTS

REPORT NO.	MAP AREA
3	South Western
4	South Central
5	Winnipeg and Morris
6	Rossburn and Virden
7	Carberry
8	West—Lake
9	Grandview
10	Nelson River Basin
11	Pasquia
12	Fisher and Teulon

FIGURE 1

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Preface

THE DETAILED-RECONNAISSANCE SOIL SURVEY of the Fisher and Teulon Map Sheet Areas is the twelfth of a series of reports devoted to the description of the soils of Manitoba as determined through the work of the Manitoba Soil Survey. The object of the survey was to obtain the essential facts about the soils of the area—their kind, distribution and agricultural features. The publication consists of two parts, two colored soil maps and a report.

The survey of the Fisher and Teulon map areas is called a detailed-reconnaissance survey because the kind of soil separations that are shown on the soil maps vary in different portions of the mapped area. Soil series and phases of series are shown separately wherever it is possible on the scale of mapping. This is mainly within the lake basin and terrace region where the soils are often uniform over large continuous areas. In the majority of the till plain area various soil series occur in intricate patterns and cannot be shown separately on the scale of mapping. Here the map units are mostly complexes of two or three series that occur within the outlined areas. However, where individual series occupy continuous areas larger than approximately 40 acres they are shown separately. Soil associations, which have been the common mapping unit in previously surveyed areas in Manitoba, are used in this report only in the sketch map showing general soil areas (Figure 11).

The soil maps included in this report indicate the distribution and area of the soil series, phases and complexes. They are published at the scale of 1: 100,000 or approximately 5/8 of an inch equals one mile. Township and Range numbers are shown along the margin of the maps. Soil series, phases and complexes are identified by color and letter designations. Complexes are colored the same as one of the included series, usually the best drained member. A key to the color and letter designations appears in the descriptive legend at the bottom of the maps.

The report describes the cultural and physical features of the map areas and the formation, character, capabilities and limitations of the soils. The report is divided into four parts. Part I describes the location and extent of the area, the population distribution and the transportation and market facilities. Part II describes the physical features including relief, drainage, geology, climate and vegetation. Part III presents a key to the soils of the area, describes the general soil areas, and gives a detailed description of the physical, morphological and agronomic features of each series. Part IV presents a grouping of the soils into soil agronomic groups, a table indicating the adaptability of each soil to regional crops, and outlines the history of settlement and present land-use.

Acknowledgments

THE SOIL SURVEY of the Fisher and Teulon map sheet areas was conducted as a joint project of the Canada Department of Agriculture; the Manitoba Department of Agriculture and Conservation; the Lands Branch, Manitoba Department of Mines and Natural Resources; and the Department of Soil Science, The University of Manitoba.

Acknowledgment is made to Dr. A. Leahey, Canada Department of Agriculture and Dr. R. A. Hedlin, Department of Soil Science, The University of Manitoba, for their critical review of the report, and to Dr. P. O. Ripley for his review of the Agriculture section of the report.

The soils were mapped by L. E. Pratt, F. P. Leclaire, J. A. Barr, R. E. Smith, G. Emmond and W. Janke under the direction of W. A. Ehrlich. Those assisting in the field work were: J. Friesen, J. Giles, J. Manns, G. Shaw, H. Smallwood, D. Stammen, and F. Wilson. Mrs. Helen E. Gallagher assisted in the recording of field and laboratory data and in the preparation of the report.

The final drafting and printing of the soil maps was undertaken and financed by the Research Branch, Canada Department of Agriculture, and the printing of the report was undertaken and financed by the Manitoba Department of Agriculture and Conservation.

Summary

THE DETAILED-RECONNAISSANCE SOIL SURVEY of the Fisher and Teulon Map Sheet Areas covers 3,707 square miles in the southern Interlake district of Manitoba. This district comprises the portion of the Manitoba Lowlands between Lake Manitoba and Lake Winnipeg. It is well known locally for the general high-lime content and stoniness of the soils. The topography is level to gently undulating and much of the land has a distinctive low ridge and swale form with a general north-west to south-east linear pattern. The climate is sub-humid with a definite summer maximum of precipitation. Slow surface drainage affects the soil moisture regime over much of the area. The native vegetation is dominantly aspen woods, with some bur oak in the southern portion and white spruce in the northern portion.

The mapped area may be divided into two main regions on the basis of physical features and agricultural value. Approximately 65 percent of the area consists of a stony till plain with many features that tend to restrict its agricultural use. The glacial till is very high in lime carbonate content, having been derived mainly from the underlying limestone rocks. In some places the limestone bedrock is exposed at the surface or covered by only a few inches of glacial drift. The soils belong to the Isafold and Garson associations. They are all very stony and have very thin surface horizons. The other 35 percent of the mapped area consists of a glacial lake basin and terrace area with lacustrine soils of much greater agricultural value. These soils range in texture from sand to clay. Some are imperfectly to poorly drained and high in lime content, while others on higher land are well-drained and degraded under woods. Over much of the area the lacustrine sediments are thin and are underlain with high-lime till.

Most of the cultivated land is within the lake basin and terrace area in the eastern part of the map areas. The Teulon, Arborg and Fisher Branch districts are the centers of grain production along with some dairying and livestock farming. Within the till plain, the farmers depend mainly on livestock, dairying and poultry production for their livelihood. The grain grown in the scattered areas of cultivated land is principally oats and barley for livestock feed. While some large ranches exist, particularly along the shore of Lake Manitoba, most herds are small. The carrying capacity of the bush covered land is low and very little pasture improvement has been attempted.

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PART I

GENERAL DESCRIPTION OF AREA

A. LOCATION AND EXTENT

The Fisher and Teulon map areas lie in the southern portion of the Interlake district of Manitoba between Lake Manitoba and Lake Winnipeg. The location of the areas with respect to other soil map areas is shown in Figure 1. The Fisher and Teulon maps include Townships 15 to 25 in Ranges 7 west to 5 east of the Principal Meridian and cover approximately 2,372,531 acres. The map areas include: the Municipalities of Bifrost, Gimli, Coldwell and St. Laurent; the Local Government District of Armstrong; portions of the Municipalities of Siglunes, Eriksdale, St. Andrews, Rockwood, Woodlands and Portage; and portions of the Local Government Districts of Fisher and Grahamdale (see Figure 2).

B. POPULATION

According to the 1956 census, the total population of the Fisher and Teulon map areas was 28,245. This represents a population density of about 7.5 people per square mile. Approximately 14 percent of these people live in the incorporated towns of Gimli, Winnipeg Beach, Riverton and Teulon and 20 percent live in unincorporated towns, villages and settlements (see Table 1). The average density of farm population is about 5 people per square mile. However, the density varies greatly in different portions of the map areas (see Figure 3). The population is concentrated in areas with a large percentage of cultivated land and in towns and villages along the railways and highways. The unusually large rural population indicated in the Gimli district is due primarily to census inclusion of Air Force personnel stationed at the Air Base in that township.

TABLE 1

Population of Incorporated and Unincorporated Towns, Villages and Settlements

INCORPORATED TOWNS			
Gimli	1,660		
Winnipeg Beach	805		
Riverton	795		
Teulon	634		
UNINCORPORATED TOWNS AND VILLAGES			
St. Laurent	856	Shorncliffe	173
Arborg	762	Petersfield	141
Lundar	647	Framnes	130
Ashern	417	Poplarfield	123
Fisher Branch	374	Chatfield	110
St. Ambroise	316	Komarno	105
Oak Point	284	Sandy Hook	89
Inwood	243	Hnausa	81
Hodgson	234	Broad Valley	66
Eriksdale	190	Washow Bay	65

C. TRANSPORTATION AND MARKETS

The more densely populated portions of the Interlake district are well provided with road and rail facilities (Figure 4). The railways and most highways radiate from Winnipeg and traverse the district in a north-south direction, serving most communities with ready access to the Winnipeg market. A network of secondary roads serve the local farm districts. Graded earthen roads have been constructed around most sections of land in the better farming districts, whereas only a few have been built in areas of sparse population.

Most of the agricultural produce is transported to markets outside of the map areas. Local towns and villages provide a small market for dairy and vegetable products, and local creameries provide processing facilities for some produce. The principal market and processing facilities are located at Winnipeg, 25 miles south of the Teulon map area.

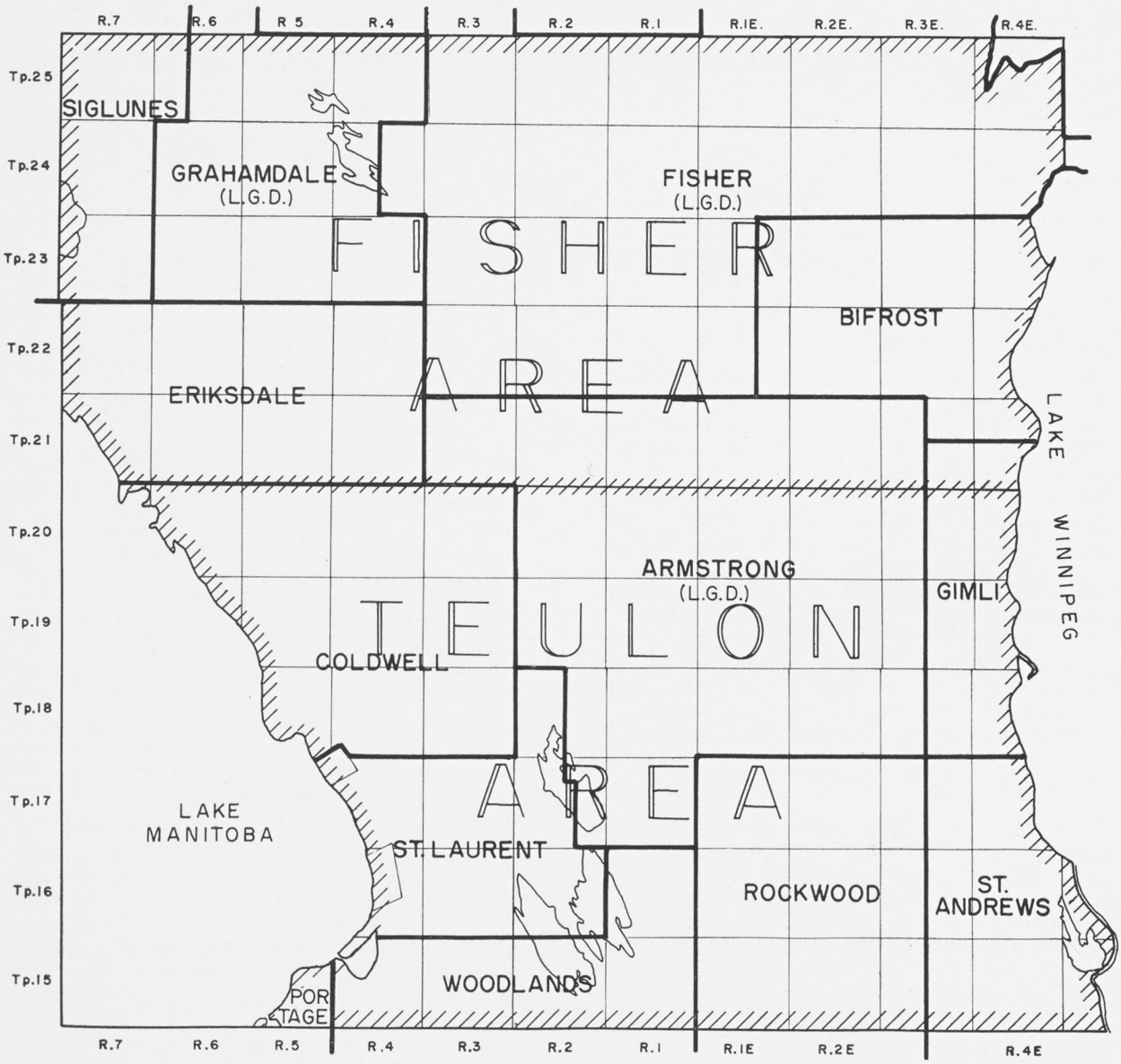
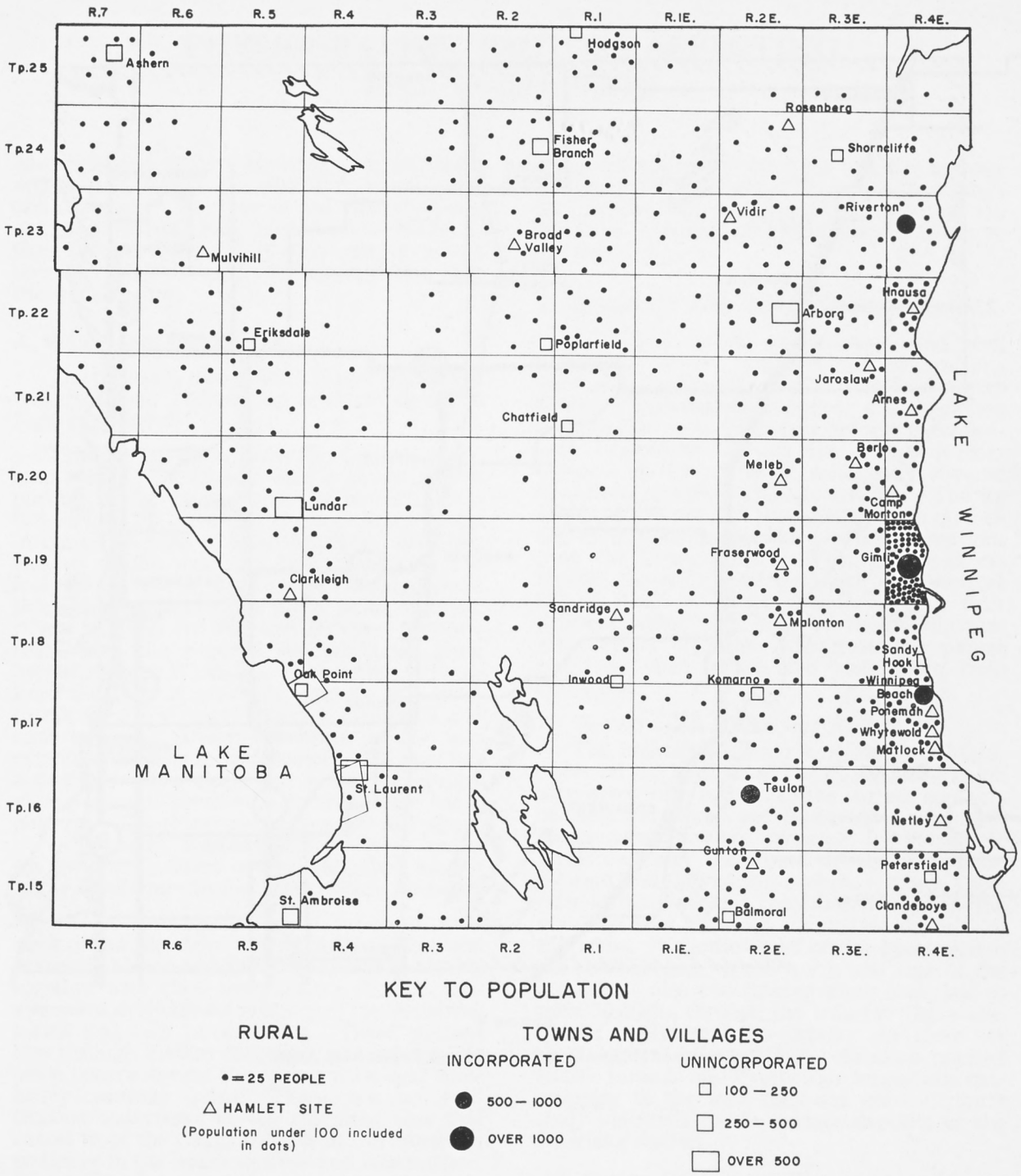


FIGURE 2

Municipalities in the Fisher and Teulon Map Areas.



KEY TO POPULATION

RURAL

•=25 PEOPLE

△ HAMLET SITE

(Population under 100 included in dots)

TOWNS AND VILLAGES

INCORPORATED

● 500 — 1000

● OVER 1000

UNINCORPORATED

□ 100 — 250

□ 250 — 500

□ OVER 500

FIGURE 3

Distribution of Population in the Fisher and Teulon Map Areas.

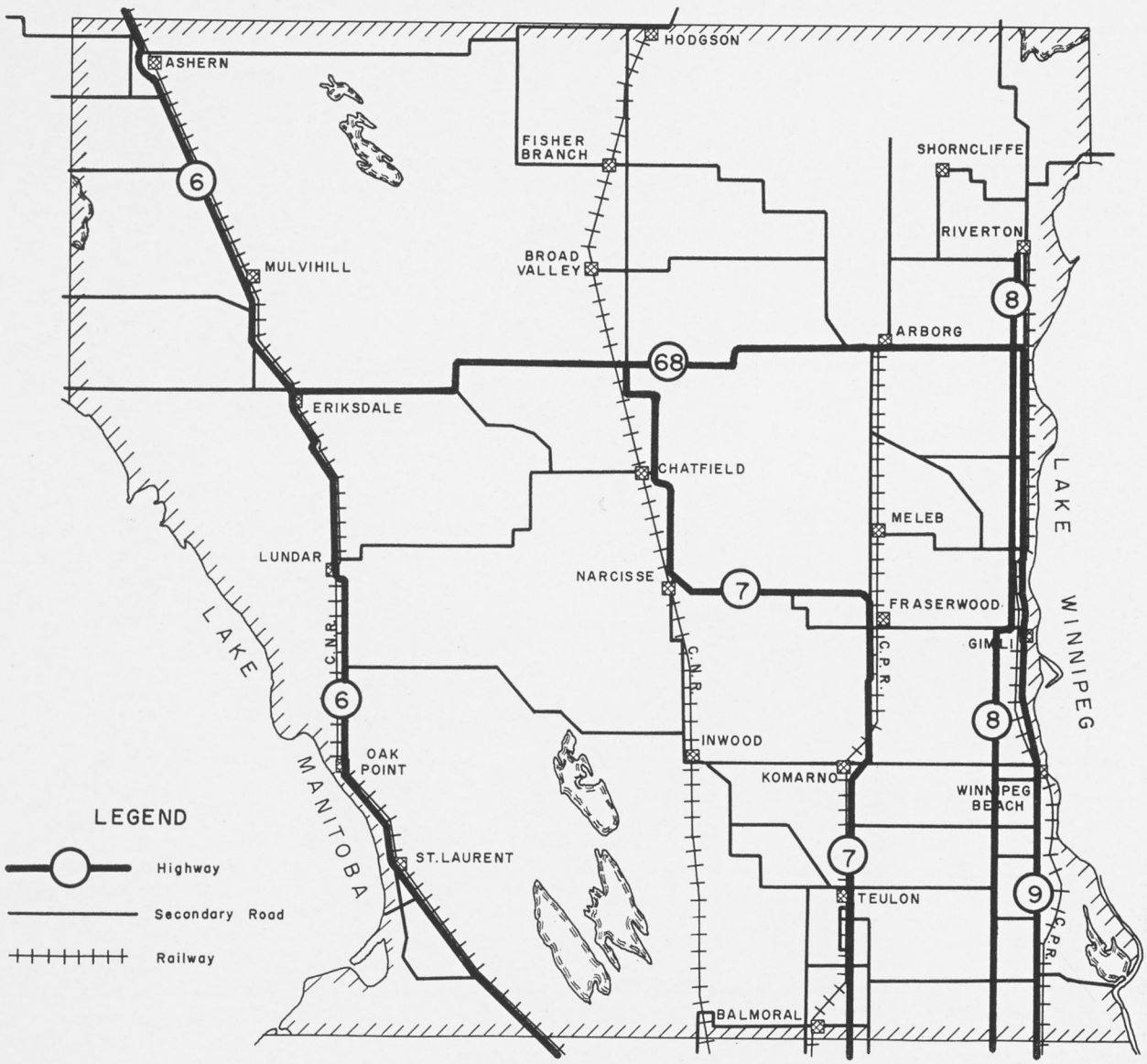


FIGURE 4

Railroads and Highways in the Fisher and Teulon Map Areas.

PART II

PHYSIOGRAPHIC FACTORS AFFECTING SOIL FORMATION

The principal factors affecting soil formation are climate, vegetation, parent material, relief and drainage. The type of soil formed at any one place is dependent upon the interaction of these factors, the length of time they have been operative and the modifications resulting from the work of man.

A. RELIEF AND DRAINAGE

The principal relief and drainage features of the Fisher and Teulon map areas are shown in Figures 5 and 6.

There are no prominent relief features in the map areas. The highest land is in the central portion, where the elevation ranges from 875 to 925 feet (A.S.L.). From there it slopes gently in both directions to Lake Manitoba (814 feet A.S.L.) on the west and Lake Winnipeg (714 feet A.S.L.) on the east. On the eastern side of this height of land there are a series of beach ridges between the 850 and 800 feet contours that mark the edge of the lacustrine plain bordering Lake Winnipeg. Below these strandlines the land is generally smooth and level, except for a few broad ridges of glacial till and rock outcrop. Above the beach ridges, and extending west to Lake Manitoba, the land has a distinctive low ridge and swale topography with a general north-west to south-east linear pattern. The ridges rise only a few feet above the intervening depressions but, lying across the general direction of land fall, they have a major damming effect on the country drainage.

Surface drainage is poorly developed over most of the Interlake district. The Fisher and Icelandic rivers and Osier and Netley creeks, together with their contributory ditches, provide some drainage for portions of the lacustrine plains and lake terrace area. These streams flow through shallow channels and local flooding often occurs during the spring thaw and after heavy summer rains. There are no continuous waterways in the till plain area and runoff from the ridges collects in the adjoining swales or in the larger swamps and intermittent lakes. The largest of these lakes are the three Shoal Lakes, Dog Lake, Sleeve Lake and Chatfield Lake. They have no natural outlets and are bordered by salt flats, marshes or bogs. Drainage improvement of these areas is difficult due to the lack of natural channels and the presence of numerous ridges perpendicular to the land fall.

B. GEOLOGY AND SOIL PARENT MATERIALS

A surface mantle of unconsolidated rock materials covers the bedrock formations throughout most of the Fisher and Teulon map areas. These unconsolidated materials are composed of rock fragments derived from bedrock formations through the action of continental ice sheets which completely covered Manitoba in recent geological times. The ice sheets picked up and transported huge quantities of materials from the bedrock formations over which they passed. When the ice sheets melted the rock materials were deposited as glacial drift in various forms. These drift deposits, along with areas of recent alluvium and organic deposits, constitute the parent materials from which the soils have been developed.

(i) Geology of the Underlying Rocks

The bedrock formations of southern Manitoba and the location of the Fisher and Teulon map areas with respect to the surface contacts of these formations are illustrated in Figure 7. These map areas are underlain by Palaeozoic limestones and dolostones of the Devonian, Silurian and Ordovician periods. It was these rock formations that contributed most of the materials that make up the surface deposits of the areas. Granitic rocks of the Precambrian era that outcrop to the north and east of the map areas also contributed some materials to these deposits through the transporting action of the continental ice sheets. As these ice sheets moved in a southerly direction parallel to the Jurassic and Cretaceous formations outcropping to the west they did not contribute shaly materials to the surface deposits of the Interlake district.

(ii) Surface Deposits and Physiographic Areas

The distribution of the surface deposits and the physiographic areas occurring in the Fisher

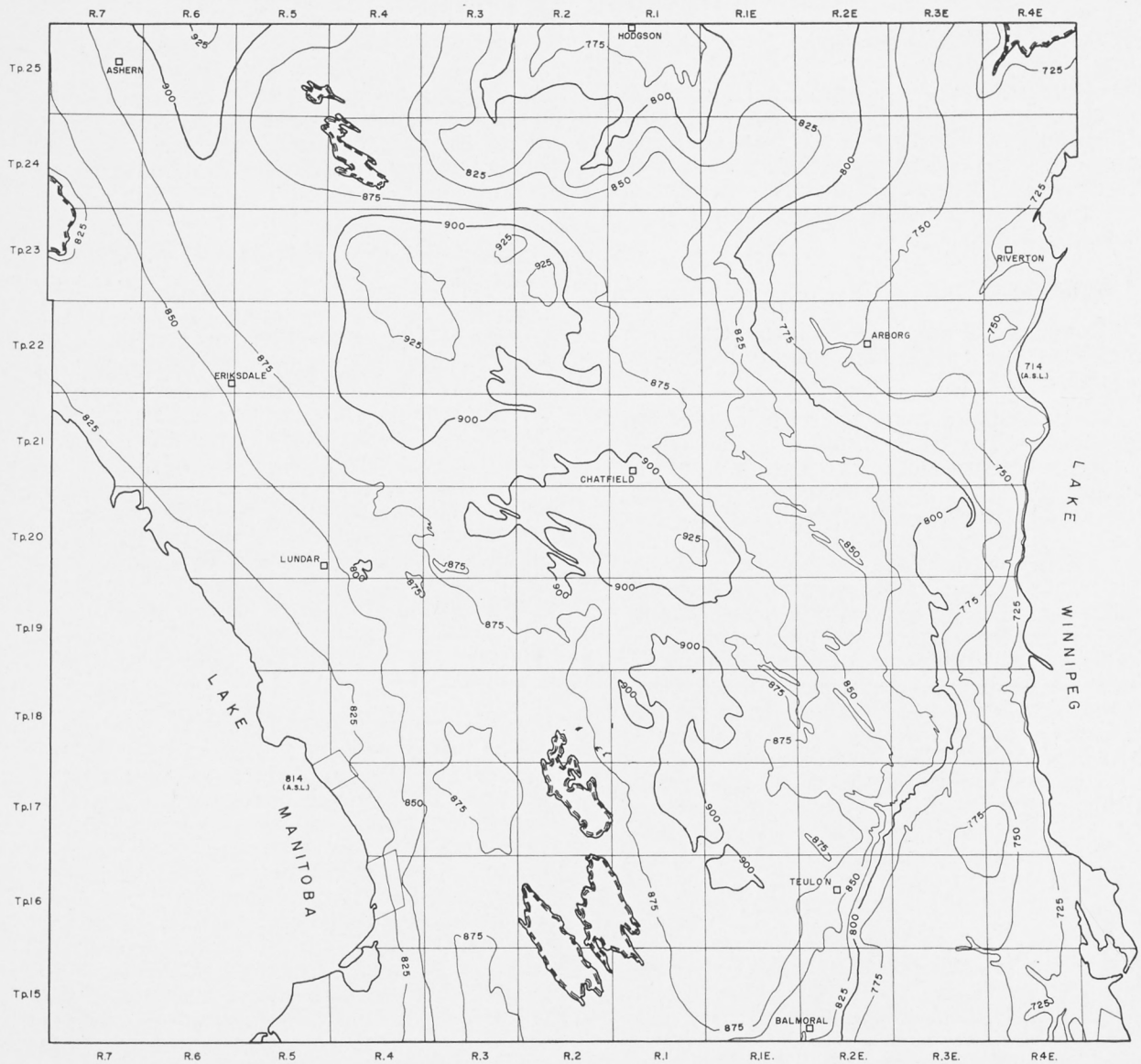


FIGURE 5

Contour Map of the Fisher and Teulon Map Areas.

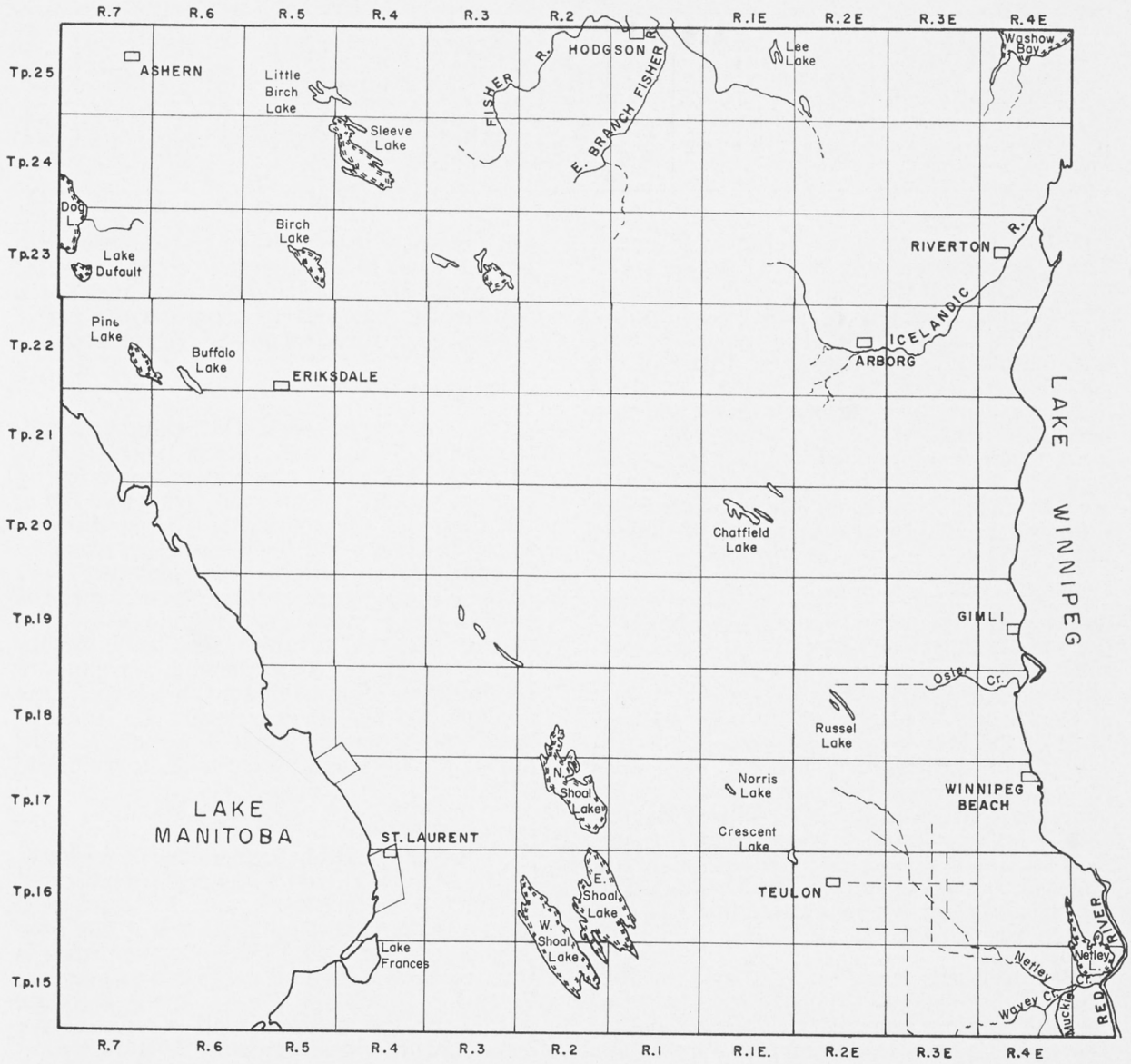


FIGURE 6

Drainage System of the Fisher and Teulon Map Areas.

TABLE 2

The Mean Monthly Temperatures in Degrees Fahrenheit Recorded at Gimli, Moosehorn and Winnipeg

Station	No. of Years Recorded	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Mean
Gimli.....	16	—2.2	3.4	15.9	35.9	48.6	59.6	62.4	64.3	53.1	42.5	23.6	6.6	34.5
Moosehorn...	25	—4.1	2.2	13.6	34.7	49.4	59.2	65.4	62.4	51.3	40.8	21.7	4.8	33.8
Winnipeg....	85	—2.1	2.2	16.5	38.0	52.1	62.2	67.2	64.5	54.1	41.5	22.1	6.8	35.4

and Teulon map areas are shown in Figure 8. The map areas may be divided between two major regions on the basis of surface deposits. The larger of these regions, called the Interlake Till Plain, consists dominantly of ground moraine deposits and the other, a part of the glacial lake basin and terrace region, consists of lacustrine deposits of various textures and thin lacustrine deposits over glacial till. This latter region is sub-divided into four local areas on the basis of various physical features. These are: the Fisher River Plain, the Icelandic River Lowland, the Red River Plain and the Winnipeg Lake Terrace.

The Interlake Till Plain is a gently undulating area of ground moraine consisting of dominantly limestone materials. In some portions of the area limestone bedrock outcrops at the surface or is covered by only a thin mantle of glacial drift. All the soils are very stony. Most of the area is covered by scrubby aspen, with minor occurrence of bur oak and white spruce. The trees are stunted in growth by the high-lime content of the soils, subsoil salinity and by restricted rooting space where the bedrock is close to the surface. Areas of natural grassland occur bordering Lake Manitoba and the Shoal Lakes, where soil salinity has prevented tree growth.

The Icelandic River Lowland and the Red River Plain are level to depressional areas of fine and medium textured lacustrine deposits. The lowest portions of these areas are poorly drained and have a layer of peat covering the clay deposits. The Red River Plain originally was grassland, while the Icelandic River Lowland had a forest vegetation of spruce and aspen. Both areas are now largely cultivated.

The Winnipeg Lake Terrace and the Fisher River Plain are areas of shallow lacustrine deposits over till. The topography in these areas is generally level to gently undulating with greater local relief adjacent to the ridges of glacial till and rock outcrop. Soil drainage is dominantly imperfect to good and the native vegetation is mixed aspen and spruce woods.

C. CLIMATE

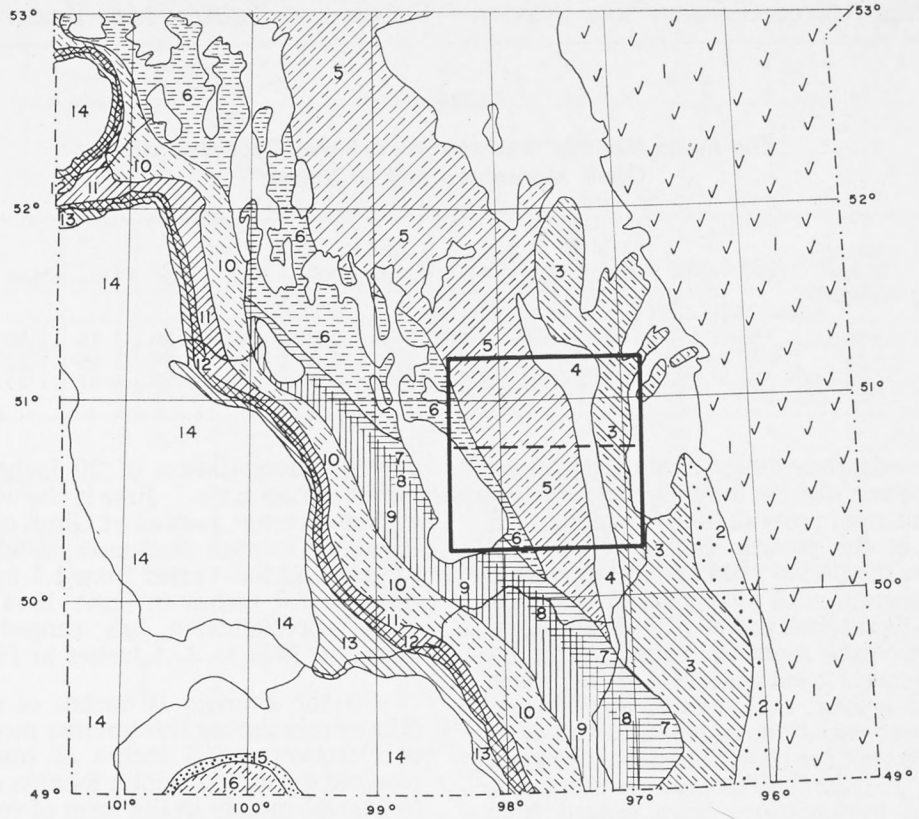
In relation to world-wide climatic conditions, the Fisher and Teulon map areas of Manitoba are within the region designated by Köppen as Dfb.* This is an area which lies in the centre of the continent, a great distance from the oceans and their modifying effect on temperatures. Summer temperatures are higher, winter temperatures lower, and the annual range much greater than the world average for the latitude. The area is subhumid and has a definite summer maximum of precipitation. Approximately 75 percent of the precipitation falls as rain during the period of April to October and about 25 percent as snow during the five winter months of November to March.

(*i*) *Temperature*

The mean monthly temperatures recorded at Gimli, Moosehorn and Winnipeg are presented in Table 2. Gimli is the only Meteorological Station within the map areas and it has been in operation for only 16 years. Moosehorn is situated 5 miles north of the Fisher map area in Township 26, Range 7 west of the Principal Meridian. Intermittent weather records have been kept at Moosehorn since 1910 and complete records are available for 25 years. Winnipeg, situated 25 miles south of the Teulon map area, has complete records for 85 years.

Although the temperature data presented in Table 1 for Gimli, Moosehorn and Winnipeg are not strictly comparable because of the variable

*W. Köppen and Geiger, "Handbuch der Klimatologie", Band I, Teil C, Gebrüder Borntraeger, Berlin, 1936.



KEY TO ROCK FORMATIONS

CENOZOIC

TERTIARY

16 TURTLE MTN. FORMATION: Mottled shales and lignite beds

MESOZOIC

CRETACEOUS OR TERTIARY

15 BOISSEVAIN FORMATION: Sandstone

UPPER CRETACEOUS

14 RIDING MTN. FORMATION: Light grey hard shale and soft greenish shale

13 VERMILION RIVER FORMATION: Acid and calcareous shales, some bentonite

12 FAVEL FORMATION: Grey shale, some limestone and bentonite

LOWER AND UPPER CRETACEOUS

11 ASHVILLE FORMATION: Dark grey shale with lime and sandy beds

LOWER CRETACEOUS AND EARLIER

10 SWAN RIVER GROUP: Sandstone, shale and low grade coal

JURASSIC AND EARLIER

9 SUNDANCE FORMATION: Glauconitic sandstone, shale, limestone and gypsum

8 GYPSUM SPRINGS FORMATION: Red shale and gypsum

7 SPEARFISH FORMATION: Red to brown shales and red argillaceous sandstone

PALAEOZOIC

DEVONIAN

6 UNNAMED DEVONIAN: Limestone and dolostone

SILURIAN

5 INTERLAKE GROUP: Dolostone

ORDOVICIAN

4 STONY MTN. FORMATION: Limestone and dolostone, red shale

3 RED RIVER FORMATION: Limestone and dolostone

2 WINNIPEG FORMATION: Sandstone, minor shale

ARCHEAN OR PROTEROZOIC

Chiefly acidic intrusive rocks

FIGURE 7

Bedrock Formations in Southern Manitoba.

TABLE 3

The Mean Monthly Precipitation in Inches Recorded at Gimli, Moosehorn and Winnipeg

Station	No. of Years Recorded	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Mean
Gimli.....	16	.96	.73	.94	.92	2.00	3.38	2.91	2.64	2.30	1.75	1.52	1.52	21.14
Moosehorn...	25	1.10	.80	1.00	1.13	1.74	3.11	1.89	2.86	1.97	1.56	1.33	.94	20.04
Winnipeg....	85	.89	.85	1.11	1.11	2.17	3.16	3.00	2.49	2.27	1.47	1.11	.92	20.67

length of records, they indicate that the average temperatures are slightly lower in the northern portion of the map areas than at Winnipeg. A comparison of the records kept at Gimli and Winnipeg for the period 1944 to 1959 shows the same relationship, with yearly mean temperatures of 34.5°F at Gimli and 36.3°F at Winnipeg. While the average monthly temperatures indicate the general conditions of a short, warm summer and a long, cold winter, they do not show the great variations in seasonal and daily temperatures that are characteristic of the area. Within the 16 years of records at Gimli the yearly mean temperatures have ranged from 32.7 in 1951 to 37.2 in 1953, and the monthly means show ranges of 10 to 25 degrees. Temperatures are particularly variable during the spring and fall seasons when the region is affected by series of low pressure centres passing along the Polar front between the cold and warm air masses. The daily range in temperature is normally 15 to 20 degrees and sharper changes often accompany frontal disturbances during the fall, winter and spring seasons.

Two commonly recognized values that indicate the length of the growing season are the frost-free period and the vegetative season.* In the Fisher and Teulon map areas the frost-free period ranges from 90 to 100 days and the vegetative season is within the range of 170-180 days.**

(ii) Precipitation

The mean monthly precipitation recorded at Gimli, Moosehorn and Winnipeg is given in Table 3. These records indicate that an average precipitation of 20 inches is general over the map areas. June is the wettest month with an average rainfall at Gimli of 3.38 inches. However, rainfall fluctuates widely from year to year and has varied from 1.1 inches in June 1946 to 7.0 inches in June 1944. The total yearly precipitation has ranged from 15.0 inches in 1948 to 27.1 inches in 1958.

On the average 15 inches of precipitation falls as rain during the summer months of April to October, and 5 inches of precipitation is received during the winter months of November to March, mainly in the form of snow. Summer rains may be in the form of frontal or convectional storms. The heavy rains of June, July and August are mostly local thunderstorms of short duration, while the spring and fall precipitation is usually of the frontal type in the form of general light rains of long duration. During the winter, snow is received in frontal storms, usually accompanied by high winds and severe drifting conditions. By spring most of the snow is usually in high drifts along roads, fence lines and bushes and open fields are barely covered.

D. VEGETATION

The area covered by the Fisher and Teulon map sheets lies within the Boreal Forest Region of Canada as delineated by Rowe.* Two sections of this region occur within the map areas and are designated as the Aspen-Oak Section and Manitoba Lowlands Section. The areas covered by these sections and some local areas of natural grassland are shown in Figure 9.

The Aspen-Oak Section forms a broad transitional zone between the Boreal Forest and the Grassland regions and has characteristics of both regions. Aspen is the most prevalent

*Frost-free period is the length of time between average dates of the last frost in spring and the first frost in autumn. Vegetative season is the average length of time during the summer months when the daily temperature is above 42°F.

**B. W. Currie. "Vegetative and Frost-free Seasons, Prairie Provinces and Northwest Territories," Physics Department, University of Saskatchewan, 1954.

*Rowe, J. S. "Forest Regions of Canada." Bulletin 123. Canada Department of Northern Affairs and National Resources, Ottawa, 1959.

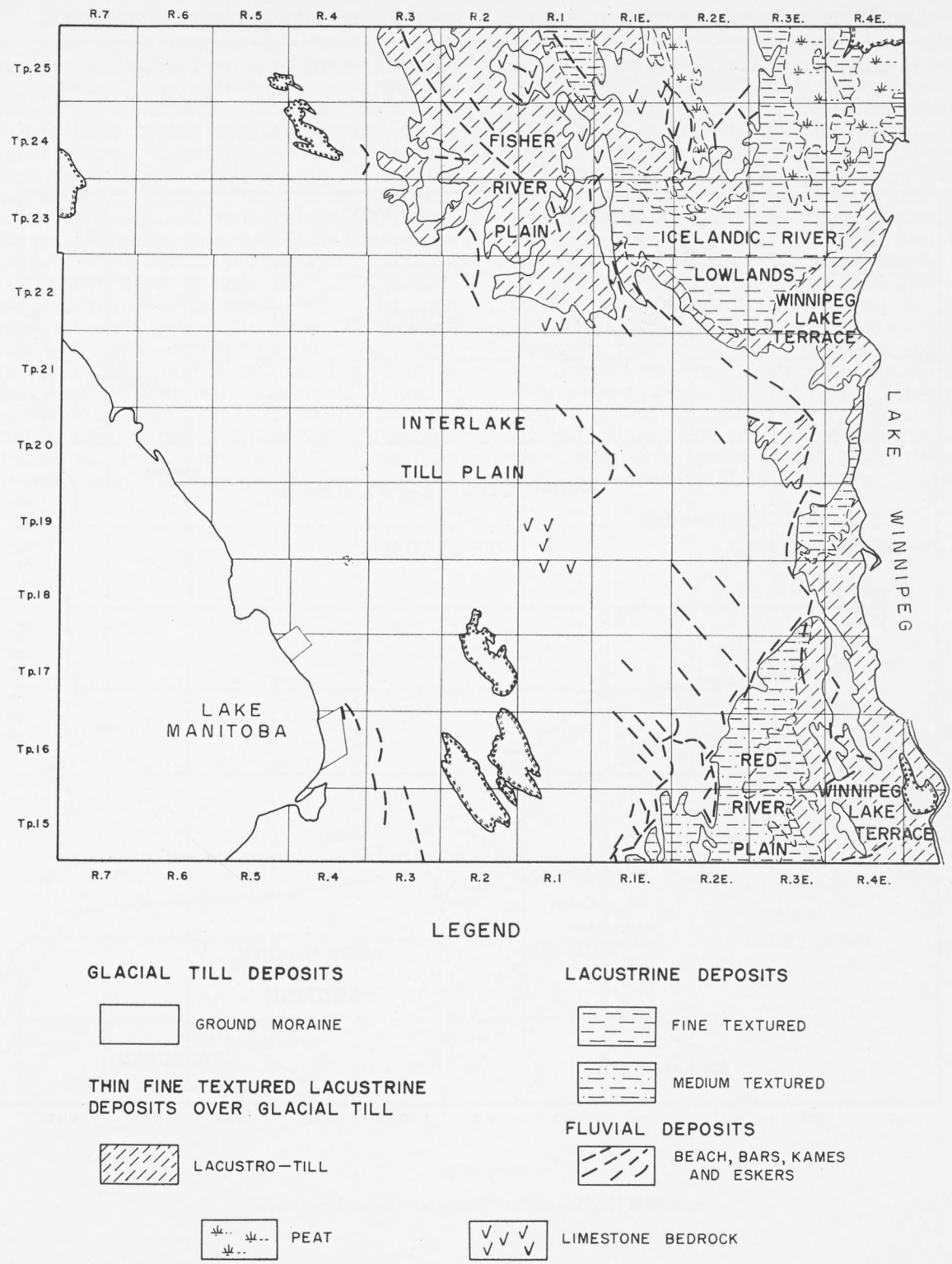


FIGURE 8

Surface Deposits and Physiographic Areas in the Fisher and Teulon Map Areas.

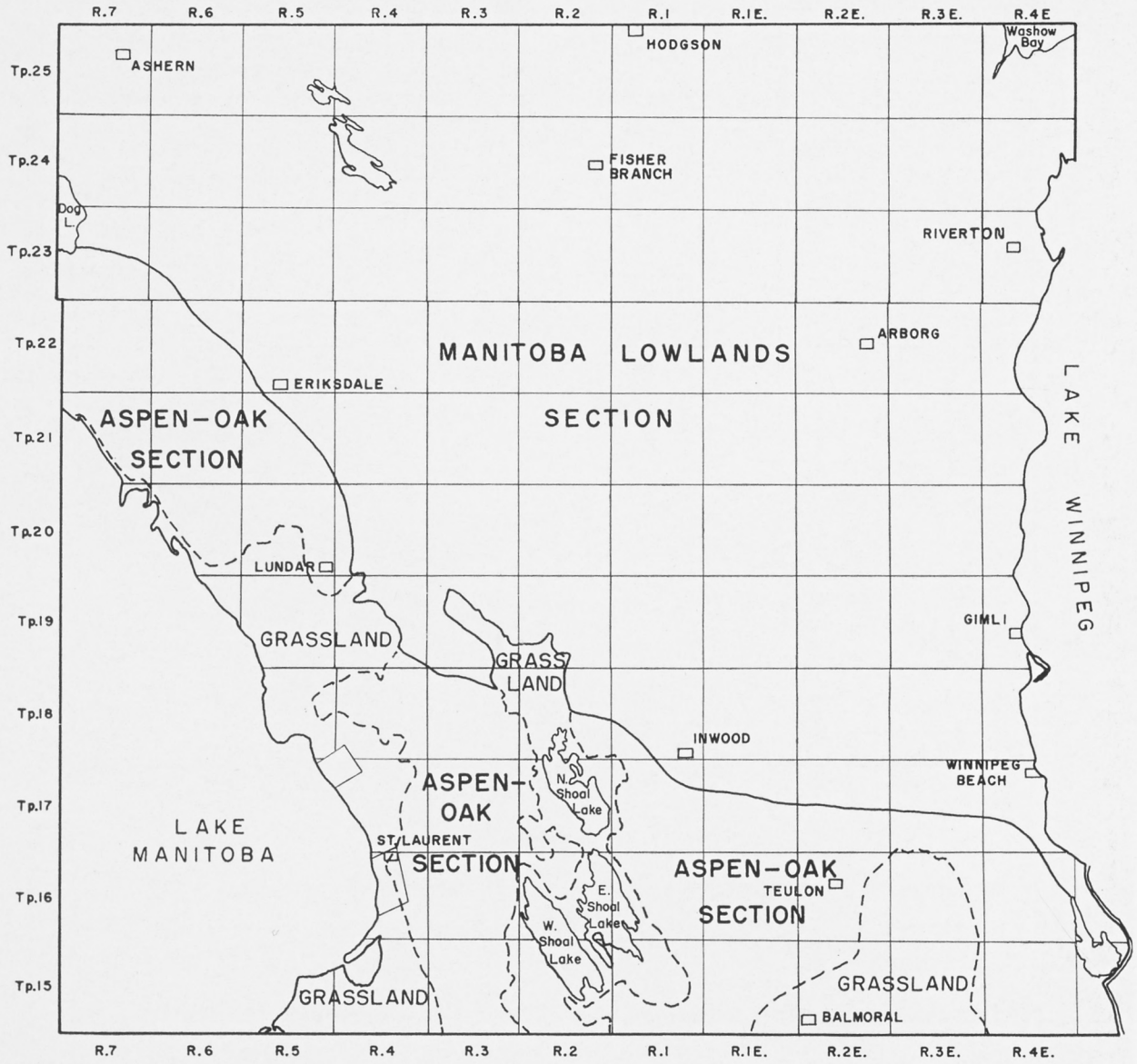


FIGURE 9

Vegetation Regions of the Fisher and Teulon Map Areas.

tree species, ranging from small groves invading the grassland, through larger and irregular clumps, to continuous stands in association with balsam poplar approaching the forest region proper. A general distribution of bur oak is characteristic of this section. Within the map areas, this species is found in stunted form on dry gravelly and well-drained till ridges. The most common grass species encountered in the Aspen-Oak Section are big and little bluestem (*Andropogon furcatus* and *A. scoparius*) and wild rye (*Elymus canadensis*). The open grassland areas that occur along the shore of Lake Manitoba, surrounding the Shoal Lakes and in the Balmoral Marsh are the result of poor drainage and soil salinity. The native vegetation in these areas is dominantly meadow grasses, reed, sedges and salt-tolerant species such as: salt grass (*Distichlis spicata*), sea-blite (*Suaeda erecta*) and samphire (*Salicornia rubra*).

The Manitoba Lowlands Section is separated from the Aspen-Oak Section on the basis of the distribution limits of the boreal conifers. While aspen is still the dominant species in the Interlake portion of this region, black spruce and tamarack are prevalent in the poorly drained areas, and white spruce and jack pine occur on the better drained ridges. Because of the high-lime content of the soils and the effects of repeated fires, the aspen stands are scrubby and worthless. These close-growing, stunted trees are a major problem to land utilization in the area. In local areas where the limestone bedrock is at or near the surface, trees cannot survive and dry grassland species, such as spear grasses (*Stipa spp.*) and Potentilla, form a sparse vegetative cover. Elm, green ash and white birch occur in association with aspen and white spruce on the better drained clay soils bordering Lake Winnipeg.

PART III

SOILS

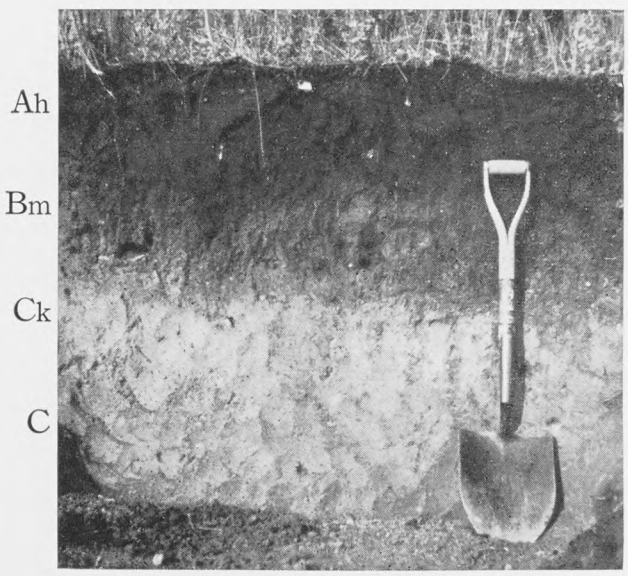
The soils that have developed under the influence of the soil forming factors described in Part II exhibit physical characteristics which reflect their environment. Through observation of these characteristics it is possible to classify soils in accordance with their genesis or the processes involved in their formation. Such a classification scheme permits the grouping of soils into natural units. The recognition of these units is dependent on the study of the soil profiles.

A. THE SOIL PROFILE

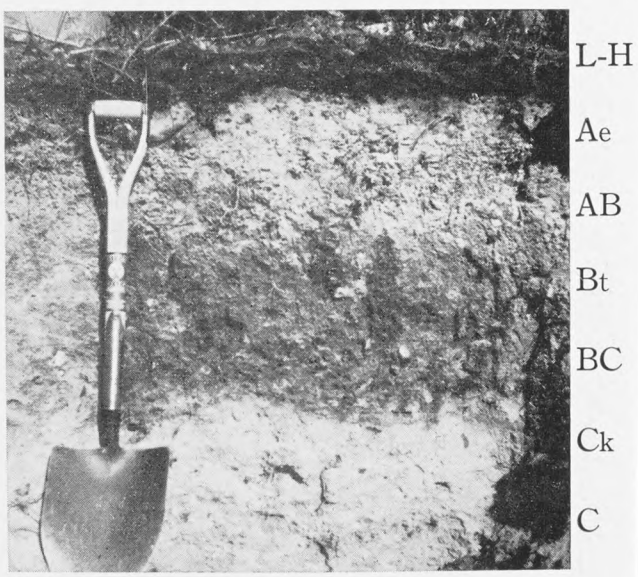
The soil profile as viewed in vertical cross section, consists of various soil layers. These layers are called soil horizons and differ from one another in one or more of the following features: color, texture, structure, consistence, reaction, concretions, intrusions, and chemical and biological composition. The main horizons are designated as L, F, H, A, B and C. Lower case letter suffixes are used to indicate the type of horizon and Arabic numeral suffixes are used when further division into sub-horizons is required. If the soil profile is developed from two or more nonconforming parent materials, Roman numeral prefixes are used to indicate the lithologic changes. The master horizon symbols and lower case letter suffixes are defined in Table 4. Examples of the use of these horizon symbols are given in Figure 10.

FIGURE 10

Examples of the Use of Soil Horizon Nomenclature.



Black soil profile showing subdivision into soil horizons.



Grey Wooded soil profile showing subdivision into soil horizons.

TABLE 4

Definition of Soil Horizon Symbols

ORGANIC HORIZONS:

L *Horizon*—An organic layer characterized by the accumulation of organic matter in which the original structures are definable.

F *Horizon*—An organic layer characterized by the accumulation of partly decomposed organic matter. The original structures are discernible with difficulty. Fungi mycelia often present.

H *Horizon*—An organic layer characterized by an accumulation of decomposed organic matter in which the original structures are indefinable.

MASTER MINERAL HORIZONS

A *Horizon*—A mineral horizon or horizons formed at or near the surface in the zone of maximum removal of materials in solution and suspension and/or maximum in situ accumulation of organic matter. It includes: (1) horizons in which organic matter has accumulated as a result of biological activity (Ah); (2) horizons that have been eluviated of clay, iron, aluminum, and/or organic matter (Ae); (3) horizons dominated by 1 and 2 above but transitional to underlying B or C (AB or A and B); (4) horizons markedly disturbed by cultivation or pasture (Aa).

B *Horizon*—A mineral horizon or horizons characterized by one or more of the following: (1) an illuvial enrichment (exclusive of dolomite or salts more soluble in water) of silicate clay, iron, aluminum, or organic matter (Bt, Bf, Bh, Bfh); (2) a concentration of weathering products believed to have been formed in situ (Bt, Bf); (3) the removal of dolomite and salts more soluble in water (Bm); (4) an oxidation of sesquioxides that give a conspicuously darker, stronger, or redder color than overlying and/or underlying horizons in the same sequum (Bmf); (5) a prismatic or columnar structure characterized by the presence of exchangeable sodium (Bn).

C *Horizon*—A mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (1) the process of gleying, and (2) the accumulation of dolomite and salts more soluble in water (Ck, Cs, Cg and C).

LOWER CASE SUFFIXES:

a —A layer disturbed by man's activities; i.e. by cultivation and/or pasturing. To be used only with A.

c —A *cemented* (irreversible) pedogenic horizon.

cc—*Cemented* (irreversible) pedogenic *concretions*.

e —A horizon characterized by the removal of clay, iron, aluminum or organic matter. Usually lighter colored than the layer below (*eluviated*).

f —A horizon enriched with hydrated iron (*fe*). It has a chroma of 3 or more and is redder than the horizon above or below.

g —A horizon characterized by reduction and grey colors; often mottled (*gley*).

h —A horizon enriched with organic matter. It must show at least one Munsell unit of value darker than the layer immediately below (*humus*). When used as the only suffix to B (Bh) this horizon must contain 10 percent or more of organic matter.

j —A horizon whose characteristics are weakly expressed (*juvenile*).

k —A horizon enriched with carbonate (*kalk*).

m—A horizon characterized by the loss of water soluble materials only. Usually slightly altered by hydrolysis and/or oxidation (*mellowed*).

n —A horizon containing over 15 percent exchangeable sodium or more exchangeable sodium plus magnesium than calcium (*natrium*). Bn horizons are characterized by prismatic or columnar structures which exhibit pronounced coatings and stainings on the surface of the peds and in addition have hard to very hard consistence when dry. An horizons are characterized by high reaction, black coatings and become massive and hard on drying.

p —A relic (not currently dynamic) horizon to be used as a prefix (*paleosol*). For example, an Ah horizon that underlies the present solum.

q —A *quasi* cemented pedogenic horizon.

r —An inherited consolidated layer (*rock*). Always used with C.

s —A horizon enriched with salt including gypsum (*salt*).

t —A horizon enriched with silicate clay (*ton*).

w—A water saturated layer; the apparent water table (*water*).

z —A permanently frozen layer (*zero*).

NOTES

1—If more than one lower case suffix is required and if one only is a weak expression then the j is to be linked to that suffix with a bar, i.e., Ahe$\bar{j}$.

2—In bi-sequa profiles the first sequum designations are to be bracketed.

B. SOIL CLASSIFICATION

The basic unit in the field classification system used in this survey is the soil series. A soil series consists of soils that are similar in physical features and chemical composition as revealed by profile characteristics. This similarity of profile features occurs only within areas of similar climate, vegetation, parent material, relief, drainage and age. Any significant variation in one or more of these soil forming factors causes dissimilarities of profile features and the soil is classified as a different series. Individual soil series may occupy large continuous land areas but more commonly are associated with other soils in a complex landscape pattern.

When soils have similar profile characteristics but vary in some physical feature that is of

importance to agriculture, the soils are classified as types or phases. Soil types are divisions of series based on minor variations in texture. Soil phases are based on external features, such as topography and stoniness, or on the presence of an unconforming substrate.

While series, types and phases are the basic units used in the field classification of soils, other categories are used to group soils into broader classes. In the classification system adopted by the National Soil Survey Committee there are six levels at which soils may be separated or grouped together. These are: order, great group, sub-group, family, series and type. In the three upper categories of order, great group and sub-group, divisions are based on major differences in morphology and in some cases the composition of horizons in the soil profile. In the lower three categories of family, series and type, divisions within any one sub-group are based on soil variations resulting from differences in composition, texture and mode of deposition of the parent materials, drainage, and differences in thickness and degree of development of soil horizons. The sub-group level of this classification system is used in this report to indicate the kind of profile that is characteristic of each soil series.

Other classification systems based on certain soil features are used to group soils for various purposes. The soil association is a group of soils, consisting of different series, developed under various drainage conditions on similar parent material. Each soil series in the association occupies a different position in the landscape and differs in profile characteristics due to the local influence of drainage and vegetation. An example of this type of group in the Fisher and Teulon map areas is the Isafold association, composed of the Isafold, Lundar and Clarkleigh series. Other types of soil classification are used to group soils that have similar productivity, management problems or engineering features. The agronomic groups and sub-groups described in this report are an example of this type of classification.

C. SOIL MAPPING

The soils of the Fisher and Teulon map areas were classified into sub-groups, series, types and phases. The mapping units used were selected to permit the presentation of the most detailed information possible on the scale used for the soil maps. Wherever individual series, or phases of series, occupy continuous areas of sufficient size to be shown on the map they were mapped separately. This was possible over most of the level area of lacustrine deposits. However, on the undulating till plain various soil series frequently form complex landscape patterns and it is often impossible to show each series separately on the small-scale soil map. Where this was found to occur, soil complexes of two or more series formed the mapping units.

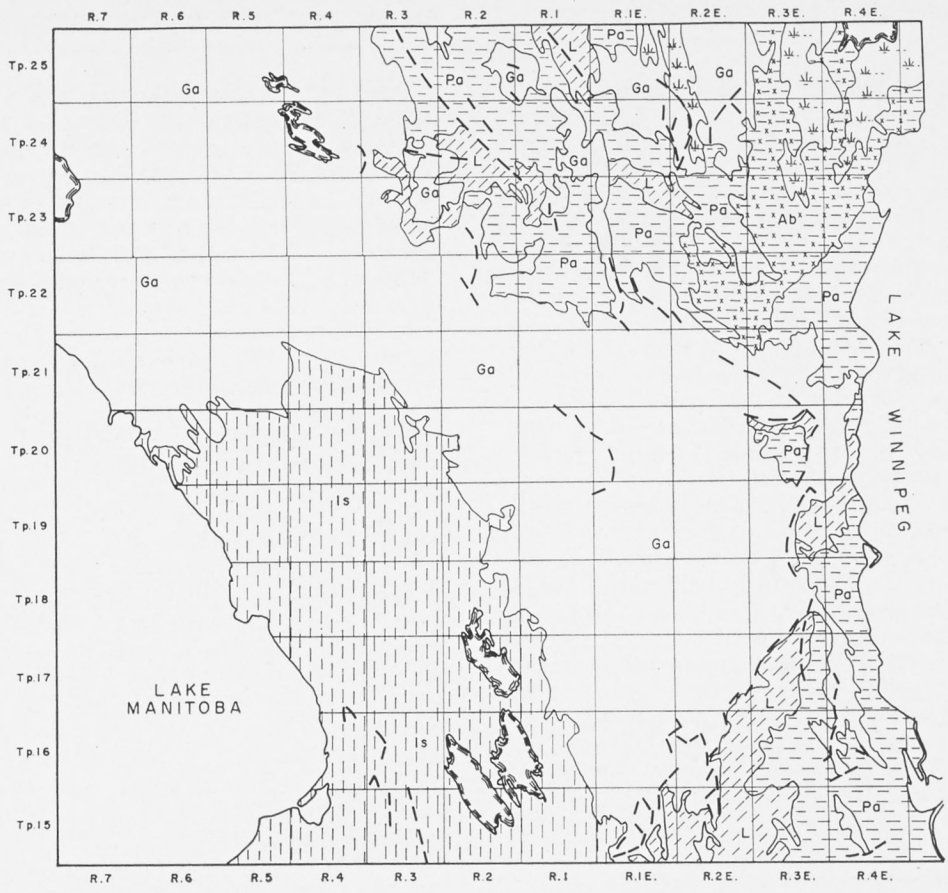
In conducting this survey a traverse was made along each road allowance, thus giving lines of traverse one mile apart and permitting the observation of at least two sides of each quarter section. Foot traverses inside the sections were made only if some important detail was required which could not be obtained from the ordinary lines of traverse. Along the road allowances the soils were examined at frequent intervals, the frequency being governed by the apparent soil variability in the area. Aerial photographs were used as base maps for plotting the soil information and as a guide to the location of soil boundaries within the sections.

D. GENERAL SOIL AREAS

A generalized soil map covering the Fisher and Teulon map areas is presented in Figure 11. On this map the soils have been grouped into seven general soil areas based on similarities of parent materials, drainage patterns and soil zonality. Some of these areas correspond to soil associations as used in previous reports. Others are broader and include soils with different zonal characteristics. A brief description of these general soil areas follows.

(1) *Isafold association*

The soils in this area generally correspond to the soils of the Isafold association as mapped in the Winnipeg, Carberry, West-Lake and Grandview map areas. The area includes soils of the Isafold, Lundar and Clarkleigh series and the Marsh and Saline Flats complexes. Local areas of Stonewall, Agassiz and Leary soils also occur. This area forms a portion of the Interlake Till Plain and the soils are thin, high in lime content and mostly very stony. The land is nearly level with low ridge and swale local relief. Most of the land is still under the natural vegetation of aspen and bur oak woods interspersed with areas of meadow grasses, sedges and reeds. The largest areas of open grassland occur bordering Lake Manitoba from St. Laurent to Clarkleigh and surrounding the Shoal Lakes. The bush cover becomes nearly



LEGEND

REGO—BLACK, CALCAREOUS AND SALINE MEADOW SOILS ON STRONGLY CALCAREOUS TILL

Is — ISAFOLD ASSOCIATION

GREY WOODED, DARK GREY AND PEATY MEADOW SOILS ON STRONGLY CALCAREOUS TILL

Ga — GARSON ASSOCIATION

REGO—BLACK AND CALCAREOUS MEADOW SOILS ON MODERATELY FINE TO MODERATELY COARSE TEXTURED LACUSTRINE DEPOSITS

L — LAKELAND ASSOCIATION

DARK GREY WOODED, DARK GREY AND PEATY MEADOW SOILS ON LACUSTRINE CLAY

Pa — PEGUIS—ARNES GROUP

SOLONETZIC AND PEATY MEADOW SOILS ON LACUSTRINE CLAY

Ab — ARBORG ASSOCIATION

SHALLOW AND DEEP PEAT SOILS

ORGANIC SOILS

DARK GREY WOODED, DARK GREY AND BLACK SOILS ON GRAVEL AND SAND

GRAVEL AND SAND BEACH RIDGES

FIGURE 11

Generalized Soil Map of Fisher and Teulon Map Areas.

continuous bordering the Garson association area.

(2) *Garson association*

The soils that occupy most of this area are members of the Garson association as mapped in the Winnipeg, Morris, West-Lake and Grandview map areas. Here they have been classified into the Garson, Stonewall, Inwood and Meleb series. The general area also contains: very poorly drained soils of the Chatfield complex, limestone rock outcrop and thin Narcisse soils over rock, and gravelly soils of the Leary and Polson complexes. This area occupies the larger portion of the Interlake Till Plain and is characterized by thin, very stony soils developed from high-lime till that have been degraded under the prevailing aspen and spruce vegetation. The land has a distinct ridge and swale topography with the ridges trending in a north-west to south-east direction. These ridges lie across the direction of general land-fall and severely hamper country drainage. While most of the area is still under natural vegetation, cultivation has been fairly extensive in some portions, notably in the district bordering No. 7 highway from Teulon to Arborg and in the Eriksdale-Ashern country.

(3) *Lakeland association*

This general soil area, which occurs principally in the northern extremity of the Red River Plain, consists mainly of soils belonging to the Lakeland association as mapped in the Winnipeg, West-Lake and Grandview map areas. In the Fisher and Teulon map areas this association has been divided into the Lakeland, Balmoral, Plum Ridge and Foley series. The general soil area also includes minor areas of Morton, Pine Ridge, Ledwyn, Berlo and Malonton soils. The Lakeland association soils are Rego Black and Meadow soils developed from medium to moderately fine textured deltaic deposits. The land is level to very gently sloping and most of the soils are imperfectly to poorly drained. The areas have been almost entirely cleared and brought under cultivation and surface drainage has been improved through the installation of ditches.

(5) *Peguis-Arnes group*

This general group of soils occupies most of the Winnipeg Lake Terrace, the Fisher River Plain and the outer portions of the Icelandic River Lowland. The group consists of Orthic Dark Grey, Dark Grey Wooded and Peaty Meadow soils developed from lacustrine clay deposits that are mostly thin and underlain by strongly calcareous till or silty deltaic deposits. These soils have been classified into the Peguis, Arnes, Framnes, Shorncliffe, Fyala and Tarno series. In the Winnipeg map area to the south similar soils were grouped into the Peguis, Semple, Red River and Fort Garry associations. Most of the land in this general soil area is level to very gently sloping and the soils are dominantly imperfectly to poorly drained. Some portions of the area bordering the Garson association have greater local relief and better soil drainage. Most of the soils have been cleared and are being cultivated or used as pasture land.

(5) *Arborg association*

The area occupying the axial portion of the Icelandic River Lowland consists of imperfectly and poorly drained soils developed from lacustrine clay deposits that are thicker than those of the Peguis-Arnes group and appear to have a higher content of soluble salts. The imperfectly drained soils of the Arborg series are Grey Wooded Solodized-Solonetz and the associated poorly drained soils of the Fyala series are Peaty Meadow. Some salinity occurs in the lower sites. The land is level to depressional and drainage is very slow. Some ditches have been constructed along road allowances and many areas of poorly drained soils have been brought under cultivation. The general area includes some peat soils that are being cultivated and cropped. There is little left of the natural vegetation, which consisted of spruce and aspen woods on the higher land and meadow grasses, sedges and reeds in the poorly drained sites.

(6) *Organic soils*

Shallow peat soils occur in depressional areas throughout most of the Fisher and Teulon map areas, but large expanses of deeper peat deposits are confined to the Icelandic River Lowland in the Washow Bay area and some deep depressions in the adjoining till plain. These areas of thick organic soils are flat and very poorly drained. The natural vegetation varies from spruce and tamarack woods to open marsh with reeds and sedges. Some portions of this general soil area in the Washow Bay district have been drained and brought under cultivation. This cultivation is generally restricted to peat soils that are less than 36 inches thick and is confined to the southern limits of the organic soil area.

(7) *Gravel and sand beach ridges*

Low ridges composed of gravel and sand materials mark the shore lines of various stages of the former glacial lake that covered this area in recent geological times. These gravelly ridges are most common along the western margin of the Lakeland association and Peguis-Arnes group general soil areas. They also occur within the Garson and Isafold association areas. The gravelly soils have been classified into the Leary complex and the Agassiz series and correspond to the well-drained members of the Leary and Agassiz associations as mapped in other map sheet areas. The ridges are mostly treed with aspen and bur oak in the southern portion, and aspen, white spruce and jack pine in the northern portion of the map areas. Few areas are cultivated and many of the larger ridges have been used as a source of gravel for road construction.

E. DESCRIPTIONS OF SOIL SERIES AND MAPPING UNITS

A key to the soils of the Fisher and Teulon map areas is presented in Table 5. The soil series are grouped according to parent materials and drainage, and the sub-group to which each series belongs is indicated in the table. The acreage figures recorded in this table are estimated total acreage covered by each series. They include the areas mapped as the individual series and phases and estimates of the portion of areas covered by each series within the mapping complexes. As an example, the total area of 95,484 acres reported for the Garson series consists of: 91,004 acres mapped as Garson series, one half of 704 acres mapped as Garson-Chatfield complex, one half of 8,101 acres mapped as Garson-Narcisse complex, and 77 acres mapped as Garson rock substrate phase.

The soil series descriptions are presented in alphabetical order and generally include: descriptions of the profile type, texture, parent material, topography, drainage and vegetation; a detailed description of a representative profile; a table of chemical and physical analyses of a representative profile; a brief description of mapping units; and a discussion of agricultural features of the soils.

Table 5

Key to Soils in Fisher and Teulon Map Areas

	Acreage	% of Total
1. SOILS DEVELOPED ON STRONGLY CALCAREOUS TILL		
(a) Well and moderately well drained		
(i) Garson series (Orthic Grey Wooded)	95,484	4.02
(ii) Stonewall complex (Dark Grey Wooded and Orthic Dark Grey)	124,545	5.25
(iii) Isafold series (Rego Black)	43,573	1.83
(b) Imperfectly drained		
(i) Inwood series (Gleyed Dark Grey)	364,819	15.36
(ii) Lundar series (Gleyed Rego Black)	111,517	4.70
(c) Poorly drained		
(i) Meleb series (Peaty Meadow)	396,718	16.72
2. SOILS DEVELOPED ON A THIN MANTLE OF SILTY SEDIMENTS OVER STRONGLY CALCAREOUS TILL		
(a) Poorly drained		
(i) Clarkleigh series (Orthic Meadow)	164,449	6.94
3. SOILS DEVELOPED ON A THIN MANTLE OF LACUSTRINE CLAY OVER STRONGLY CALCAREOUS TILL		
(a) Well to moderately well drained		
(i) Arnes series (Dark Grey Wooded)	53,120	2.24

TABLE 5—Continued

	Acreage	% of Total
4. SOILS DEVELOPED ON WEAKLY TO MODERATELY CALCAREOUS LACUSTRINE CLAY		
(a) Imperfectly drained		
(i) Peguis series (Gleyed Dark Grey)	78,364	3.31
(ii) Red River series (Gleyed Rego Black)	924	.04
(b) Poorly drained		
(i) Fyala series (Peaty Meadow)	128,705	5.42
(ii) Osborne series (Orthic Meadow)	7,935	.33
5. SOILS DEVELOPED ON SALINE LACUSTRINE CLAY		
(a) Imperfectly drained		
(i) Arborg series (Grey Wooded Solodized Solonetz)	37,617	1.59
6. SOILS DEVELOPED ON A THIN MANTLE OF LACUSTRINE CLAY OVER STRONGLY CALCAREOUS SILTY SEDIMENTS		
(a) Imperfectly drained		
(i) Shorncliffe series (Gleyed Dark Grey Wooded)	4,543	.19
(ii) Framnes series (Gleyed Dark Grey)	11,883	.50
(b) Poorly drained		
(i) Tarno series (Peaty Meadow)	46,431	1.96
7. SOILS DEVELOPED ON STRONGLY CALCAREOUS, MODERATELY FINE TO FINE TEXTURED SEDIMENTS		
(a) Imperfectly drained		
(i) Lakeland series (Gleyed Rego Black)	22,806	.96
(b) Poorly drained		
(i) Balmoral series (Peaty Calcareous Meadow)	68,160	2.87
8. SOILS DEVELOPED ON STRONGLY CALCAREOUS, MEDIUM TO FINE TEXTURED ALLUVIAL SEDIMENTS		
(a) Well to moderately well drained		
(i) Hodgson series (Mull Regosol)	1,792	.08
(b) Imperfectly drained		
(i) Fisher series (Gleyed Mull Regosol)	2,688	.11
9. SOILS DEVELOPED ON STRONGLY CALCAREOUS, MODERATELY COARSE TO MODERATELY FINE TEXTURED SEDIMENTS		
(a) Well to moderately well drained		
(i) Morton complex (Dark Grey Wooded and Orthic Grey Wooded)	10,977	.46
(b) Imperfectly drained		
(i) Ledwyn series (Gleyed Dark Grey)	3,044	.13
10. SOILS DEVELOPED ON STRONGLY CALCAREOUS MODERATELY COARSE TO MEDIUM TEXTURED SEDIMENTS		
(a) Imperfectly drained		
(i) Plum Ridge series (Gleyed Rego Black)	11,801	.50
(b) Poorly drained		
(i) Foley series (Peaty Calcareous Meadow)	1,243	.05
11. SOILS DEVELOPED ON MODERATELY CALCAREOUS COARSE TO MODERATELY COARSE TEXTURED SEDIMENTS		
(a) Well to moderately well drained		
(i) Pine Ridge series (Orthic Grey Wooded)	5,483	.23
(b) Imperfectly drained		
(i) Berlo series (Gleyed Dark Grey Wooded)	9,336	.39

TABLE 5—Continued

	Acreage	% of Total
(c) Poorly drained		
(i) Malonton series (Peaty Calcareous Meadow)	3,246	.14
12. SOILS DEVELOPED ON STRATIFIED SAND AND GRAVEL OUTWASH AND BEACH DEPOSITS		
(a) Well to somewhat excessively drained		
(i) Agassiz series (Orthic Black)	645	.03
(ii) Leary complex (Orthic Dark Grey and Dark Grey Wooded)	39,646	1.68
13. SOILS DEVELOPED ON A THIN LAYER OF MODERATELY COARSE TO FINE SEDIMENTS OVER GRAVEL		
(a) Imperfectly and poorly drained		
(i) Polson complex (Gleyed Rego Black and Peaty Meadow)	6,407	.27
14. SOILS DEVELOPED ON A THIN LAYER OF STRATIFIED DRIFT DEPOSITS OVER LIMESTONE BEDROCK		
(a) Well to somewhat excessively drained		
(i) Narcisse series (Orthic Black)	43,433	1.82
15. MISCELLANEOUS SOILS AND MATERIALS		
(a) Undifferentiated recent alluvial deposits (Orthic Regosol)	3,393	.14
(b) Shallow peat and muck deposits over undifferentiated materials		
(i) Marsh complex (Orthic Gleysol)	150,074	6.34
(ii) Chatfield complex (Peaty Gleysol and Shallow Peat)	175,104	7.38
(iii) Shallow peat with improved drainage (Shallow Peat)	17,971	.76
(c) Deep peat deposits (Deep Peat)	42,832	1.81
(d) Sandy beaches and bars (Orthic Regosol)	2,126	.09
(e) Saline Flats (Saline Regosol)	12,562	.53
(f) Limestone and dolostone rock outcrop (Orthic Regosol)	12,141	.51
(g) Lakes	54,994	2.32

AGASSIZ SERIES (645 acres)

The Agassiz series consists of weakly developed, Orthic Black soils on sandy and gravelly beach and stratified drift deposits. A few small areas of these soils occur in the southern portion of the Interlake Till Plain. The soils developed under mixed prairie grasses with occasional bur oak and scattered aspen trees. Soil drainage is good to somewhat excessive, due to the high permeability of the coarse textured material. The soils occupy low ridges with gently sloping topography. Although the parent material is gravelly, there are few surface stones.

The Agassiz soils have a four to eight-inch A horizon of very dark grey, loamy coarse sand to sandy loam that is single grained to weakly fine granular and mildly alkaline in reaction. The B horizon is weakly developed and is distinguished only by its dark brown to brownish grey color. The parent material is very pale brown, stratified sand and gravel. These soils generally have a thin sandy mantle over the gravel and coarse sandy material. As the solum is usually restricted to this sandy mantle, its thickness varies with the depth of this finer material. The following is a profile description of a representative Agassiz loamy sand soil:

Ah —0 to 6 inches, very dark grey (10YR3/1, dry), loamy sand; structureless; loose; mildly alkaline; grades through a clear, smooth boundary into:

Bm—6 to 10 inches, greyish brown (10YR5/2, dry), coarse sand; structureless; loose; moderately alkaline; grades through a clear, irregular boundary into:

Ck —10 to 18 inches, light grey (10YR7/2, dry), coarse sand and gravel; structureless; weakly cemented

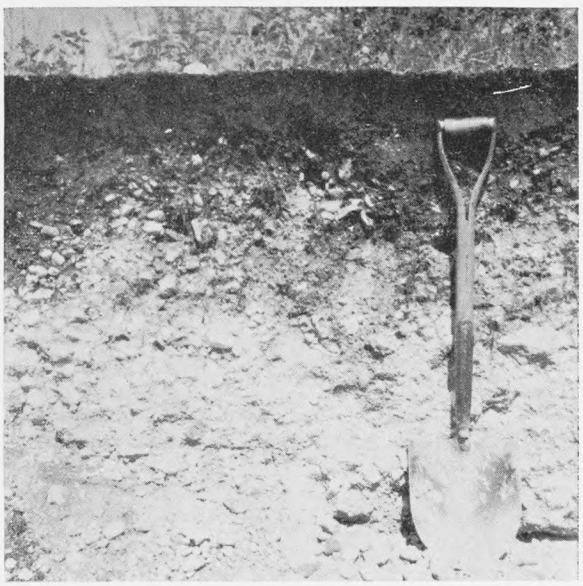


FIGURE 12

Soil profile of Agassiz sandy loam. An Orthic Black soil developed on coarse sand and gravel beach deposits.

with carbonates when dry, loose when moist; moderately alkaline, moderately calcareous; grades through a diffuse, irregular boundary into:

C —18 to 36 inches, very pale brown (10YR7/3, dry), stratified coarse sand and gravel; structureless; loose; moderately alkaline, moderately calcareous.

Agriculture:

The few small areas of Agassiz soils occurring in the Teulon map area are bordered by stony till soils of the Isafold association and are used as native pasture land.

ALLUVIUM (3,393 acres)

The narrow ribbons of bottomlands along the Icelandic and Fisher rivers were mapped as undifferentiated alluvium. These flood plain deposits are stratified and vary in texture from sand to clay, but are generally high in silt content. There has been little or no profile development on these deposits due to frequent deposition of fresh alluvium during high water stages of the rivers. The native vegetation consists mainly of willows, black poplar, meadow grasses and reeds.

Agriculture:

The poor drainage and high flooding hazard of these stream channel bottomlands render them nonarable and of limited value as hay or pasture land.

ARBORG SERIES

The Arborg series consists of imperfectly drained, Grey Wooded Solodized-Solonetz soils developed on slightly to moderately calcareous, saline lacustrine clay deposits. These soils, together with poorly drained Fyala soils, occupy the flat, lower portion of the Icelandic River Lowland. While most of this soil area is now cultivated, small uncleared areas are supporting a mixed stand of aspen, black poplar and spruce. Surface stones occur only on the till substrate phase of this series and are of little hindrance to cultivation.

The dominant feature of the Arborg soil profile is the very tough columnar structure of the Bn horizon. There is a thin, light grey, platy-structured Ae horizon at the surface and this leached material extends down the sides of the columns for several inches. The columnar aggregates are dark grey in color, extremely firm when moist and extremely hard when dry. They grade into massive clay in the lower part of the B horizon. Gypsum crystals and salt pseudomycelium are usually present in the upper portion of the C horizon. The soil is slightly acid in the A horizon, neutral to mildly alkaline in the B horizon and moderately alkaline below. The exchangeable cations in the B horizon are dominantly magnesium and sodium. The following profile description is representative of the Arborg clay soil:

L-H —3 to 0 inches, very dark greyish brown (10YR3/2, dry), leaf and sod mat; slightly acid, grades through a clear, smooth boundary into:

Ae —0 to 1 inch, grey (10YR6/1, dry), clay; moderate fine granular; hard when dry, firm when moist; slightly acid; grades through a clear, irregular boundary into:

B & A—1 to 8 inches, greyish brown (10YR5/2, dry), clay; strong medium to coarse columnar structures break into medium blocky aggregates; columns are round-topped and are coated with grey, leached material; very hard when dry, very firm when moist; medium acid; grades through a clear, smooth boundary into:

Bnt —8 to 13 inches, dark greyish brown (10YR4/2, dry), clay; strong medium blocky; extremely hard when dry, extremely firm when moist; medium acid; grades through a gradual, smooth boundary into:

BC —13 to 20 inches, greyish brown (10YR5/2, dry), clay; massive; very hard when dry, very firm when moist; neutral; grades through a diffuse, irregular boundary into:

FIGURE 13

Soil profile of Arborg clay. A Grey Wooded Solodized Solonetz developed on saline lacustrine clay. (Stick interval = 6 inches)

Ckg —20 to 27 inches, light brownish grey (10YR6/2, dry), clay; massive; hard when dry, firm when moist; moderately calcareous, moderately alkaline; iron stained; grades through a gradual, irregular boundary into:

Csg —27 to 36 inches, greyish brown (10YR5/2, dry), clay; massive; hard when dry, firm when moist; contains gypsum and carbonate concretions; moderately calcareous, moderately alkaline; iron stained.

Mapping Units

Arborg series (26,302 acres)

Areas consisting dominantly of normal Arborg soils. Small occluded areas of other soils may be present. Most common are: Arborg till substrate phase; Fyala clay and Peguis clay.

Arborg till substrate phase (11,315 acres)

Areas of Arborg soils in which a substrate of moderately to strongly calcareous till occurs within 36 inches of the surface. While this till substrate has had little effect on the morphological characteristics of the soil, the areas are usually distinguishable by the presence of scattered stones on the surface and within the soil profile.

Agriculture;

The Arborg soils are used for grain and forage production. The chief management problems arise from their clay texture, poor structure and very slow permeability. Tillage is difficult and is usually restricted to periods when the soils have an optimum level of moisture. Weeds are a severe problem. Seed germination is retarded by low soil temperatures in the spring and often by a poor seed-bed, a characteristic common to most clay soils. Organic matter content and nitrogen supply are low, and addition of fibrous materials is necessary to improve soil tilth.

ARNES SERIES

The Arnes series are Dark Grey Wooded soils developed on a thin mantle of lacustrine clay over moderately to strongly calcareous till. The surface clay layer may be up to 30 inches

TABLE 6

Analysis of Arborg Clay

Hor.	Depth inch	% Sand	% Silt	% Clay	pH	Cond. mmho s/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	3-0				6.0			21.97	1.47	14.9	72.9	47.1	24.7	0.0	2.7	—-
Ae	0-1	11.8	24.2	64.0	6.0	—	—	2.80	0.28	10.0	33.5	11.4	15.1	2.6	1.3	5.1
B&A	1-8	3.5	12.6	83.9	5.7	—	—	0.67	0.14	—	40.3	13.3	24.2	0.7	1.0	5.1
Bnt	8-13	2.4	10.3	87.3	5.1	1.15	—	0.98	0.11	8.9	44.2	3.0	31.5	8.7	1.0	—
BC	13-20	2.3	7.7	90.0	7.1	2.33	—	0.45	0.08	—	43.2	7.6	33.1	1.5	1.0	—
Ckg	20+	4.0	14.8	81.2	7.8	3.93	23.9	0.16	0.03	—	28.4					

thick, but is generally between 6 and 20 inches in thickness. The underlying glacial till may be clay loam or clay in texture and, in some places, appears to contain bands of lacustrine clay interbedded with clay loam till. These soils occur mainly in the southern portion of the Winnipeg Lake Terrace area and, to a minor extent, in the Fisher River Plain. The topography is level to irregular, very gently sloping and the soils are moderately well drained. The native vegetation consists of mixed aspen and spruce forest. Surface stoniness varies with the thickness of the clay mantle over the till and moderate hindrance to cultivation occurs in areas where the till is close to the surface.

The Arnes soils have a thin, very dark grey Ah horizon, a thin, light brownish grey Aeh horizon and a moderately well developed, blocky structured, dark greyish brown Bt horizon. The BC horizon, of variable thickness, extends down to the contact of the clay mantle and the underlying till. The solum is clay in texture throughout, although there has been considerable movement of clay from the A to the B horizon. The following profile description is representative of the Arnes clay soil:

L-H—1 to 0 inches, very dark greyish brown (10YR3/2, dry), leaf mat; neutral; grades through a clear, smooth boundary into:

Ah —0 to 1 inch, very dark grey (10YR3/1, dry), clay; moderate fine granular; friable when moist, slightly hard when dry; slightly acid; grades through a clear smooth boundary into:

Aeh—1 to 3 inches, light brownish grey (10YR6/2, dry), clay; weak coarse platy, breaks to moderate medium granular; firm when moist, hard when dry; medium acid; grades through a clear, wavy boundary into:

Bt —3 to 7 inches, dark greyish brown (10YR4/2, dry), clay; strong fine blocky; very firm when moist, very hard when dry; slightly acid; grades through a gradual, irregular boundary into:

FIGURE 14

Soil profile of Arnes clay. A Dark Grey Wooded developed on a thin mantle of lacustrine clay over calcareous glacial till.

(Stick interval = 6 inches)

TABLE 7

Analysis of Arnes Clay

Hor.	Depth inch	pH	Cond. mmhos/ cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
									Ca	Mg	Na	K	H
Ah	0-1	6.1	—	—	9.72	0.77	12.6	51.4	36.2	12.7	0.3	1.3	6.5
Aeh	1-3	6.0	—	—	2.03	0.19	10.8	32.1	19.0	9.2	0.2	0.9	3.7
Bt	5-9	6.6	—	—	0.48	0.05	9.2	39.5	21.0	13.9	0.2	1.0	2.1
BC	9-13	7.8	.41	14.7	1.08	0.10	10.9	35.1	23.5	10.7	0.2	0.7	—
IIC	13-20	7.9	.35	40.3	0.09	0.07	—						

BC —7 to 13 inches, greyish brown (2.5Y5/2, dry), clay; moderate fine blocky; firm when moist, hard when dry; mildly alkaline; grades through an abrupt, irregular boundary into:

IIC—13 to 36 inches, light grey (2.5Y7/2, dry), clay loam glacial till; fine pseudo-fragmental; friable when moist, strongly cemented with lime carbonate when dry; moderately alkaline, strongly calcareous; iron stained.

Mapping Units

Arnes series (52,864 acres)

Areas consisting dominantly of normal Arnes soils. Minor occluded areas are mostly Peguis, Garson and Fyala soils.

Arnes rock substrate phase (256 acres)

Areas of Arnes soils in which limestone bedrock occurs within 30 inches of the surface. Two small areas of this soil occur north of Arborg in Township 24, Range 1E. They are flat areas in which the thin mantle of clay and till appears to have been compressed against the underlying bedrock. The sediments have a very hard, pseudo-fragmental structure and are almost impervious to water. Under natural conditions the areas have an arid appearance and resemble areas of rock outcrop. The soils are more strongly leached than the average Arnes soils and approach the Orthic Grey Wooded type in profile characteristics.

Agriculture:

The Arnes soils are among the best agricultural soils in the Fisher-Teulon map areas. They are moderately well to well drained, moderately fertile, neutral to slightly acid in reaction, and have a favorable structure and water holding capacity. Nitrogen and phosphate fertilizers will usually increase yields of grain and forage crops. Stoniness is a minor problem in some areas.

BALMORAL SERIES

The Balmoral series consists of poorly drained, Peaty Calcareous Meadow soils developed on strongly calcareous, moderately fine to fine textured deltaic sediments. Surface textures vary from clay loam to silty clay and the clay and silt content usually increase with depth. The parent material is very high in lime carbonate content and is usually saline to a variable degree. These soils occupy a large acreage in the northern portion of the Red River Plain and in scattered locations in the Fisher and Icelandic river plains. The topography is smooth, level to depressional. In most areas the poor natural drainage has been partially offset by the installation of drainage ditches. The native vegetation consists of meadow grasses, reeds and sedges with some clumps of willow and black poplar on the slightly elevated sites. Surface stones occur only on the till substrate phase and are not a serious hindrance to cultivation.

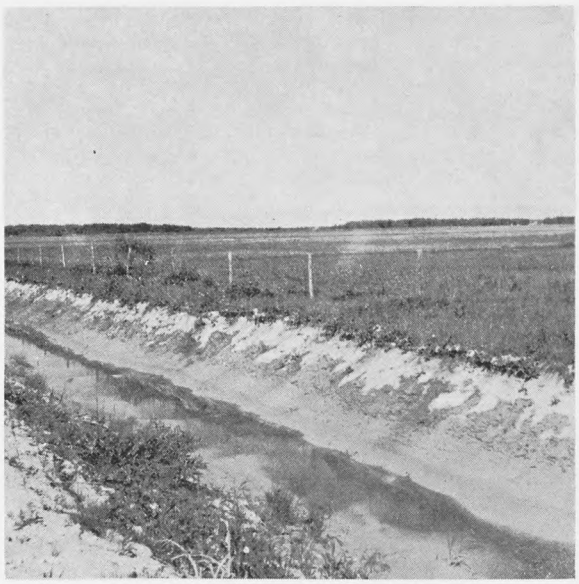


FIGURE 15

Ditch cut through area of Balmoral soils showing the thin soil developed on this very calcareous material and the flatness of the topography.

Under virgin conditions the Balmoral soils consist of a thin layer of peat, underlain by a very dark grey Ah horizon that is 3 to 6 inches thick, usually silty clay or silty clay loam in texture, granular, moderately alkaline and calcareous and may be saline. A thin, grey transitional layer containing some organic matter separates the Ah horizon from the very pale brown, strongly calcareous and usually saline parent material. In most cultivated areas the peat layer has been partially or totally destroyed or incorporated with the mineral soil. Cultivation also has resulted in a mixing of the Ah horizon with the strongly calcareous parent material, so that the plow layer is high in lime carbonate content and dry fields have a light grey color. The following profile description is representative of the virgin Balmoral soils:

L-H—7 to 0 inches, dark reddish brown (5YR3/2, dry), fen peat; mildly alkaline; grades through a gradual, smooth boundary into:

Ah —0 to 5 inches, very dark grey (10YR3/1, dry), silty clay loam; moderate fine granular; plastic and slightly sticky when wet, slightly hard when dry; moderately alkaline and calcareous; grades through a diffuse, irregular boundary into:

Cg —5 to 30 inches, very pale brown (10YR8/2, dry), silty clay; moderate fine pseudo-granular; plastic and sticky when wet, cemented when dry; moderately alkaline, strongly calcareous and moderately saline; iron stained.

Mapping Units

Balmoral series (55,108 acres)

Areas consisting dominantly of Balmoral soils, but may contain minor occluded areas of other kinds, principally Lakeland, Tarno, Fyala and Foley soils. All Balmoral soils contain soluble salts in the C horizon, but some areas are strongly saline at the surface. These areas, which occur in an irregular pattern, could not be separated on the scale of mapping used.

Balmoral till substrate phase (13,052 acres)

Areas of Balmoral soils in which a substrate of strongly calcareous glacial till occurs within 30 inches of the surface. This till substrate is very similar in texture and lime carbonate content to the overlying deltaic sediments and has not affected the soil profile. Areas of the till substrate phase are distinguishable by the occurrence of scattered stones on the surface.

Agriculture:

The chief problems involved in farming Balmoral soils are associated with their poor drainage, high lime content, salinity and, in some places, thin peat cover. In areas that are now being farmed, surface drainage has been improved through the installation of drainage ditches, and the surface peat layer has been largely destroyed. However, waterlogging and local flooding are still a hazard and some cultivated areas still have a plow layer consisting mainly of organic material. Excessive lime content in the cultivated layer is also a detriment to crop production. Applications of nitrogen and phosphate fertilizers yield good response with grain and forage crops. Strongly saline areas are best utilized for forage production, using salt tolerant grass species and fertilizers.

BERLO SERIES

The Berlo series consists of imperfectly drained, Gleyed Dark Grey Wooded soils developed on strongly calcareous, sandy deltaic sediments. Surface textures are fine sand to fine sandy loam. These soils occur in small scattered areas, generally bordering gravelly beach ridges on the margins of the lacustrine plains. The topography is level to irregular, very gently sloping. Soil permeability is rapid, but internal drainage is impeded by a finer textured substrate of glacial till that occurs at variable depths below the surface. A perched water table is present in wet seasons and often reaches the surface during the spring thaw and after prolonged summer rains. The native vegetation consists of aspen-black poplar woods with an undergrowth of willows, meadow-prairie grasses and herbs. Scattered small stones and occasional boulders occur on the till substrate phase of this series, but are only a minor hindrance to cultivation.

These soils are weakly to moderately degraded. The A horizon may be blotched with light and dark grey portions or may contain a thin or broken, dark grey Ah layer and a weakly developed, light greyish brown Ae layer. The B horizon is dark greyish brown, weak crumb structured and contains a slight accumulation of clay and humus. The lower portion of the A horizon and the B horizon are mottled

TABLE 8

Analysis of Balmoral Silty Clay Loam

Hor.	Depth inch	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-5	19.9	45.7	34.4	7.6	.88	12.3	5.42	.53	10.2	45.4	31.3	8.7	1.6	1.0	0
Cgl	5-13				8.1	2.90	41.6	0.81	.09	8.9						
Cg2	13-19	1.7	54.7	43.6	8.0	3.79	47.9	0.47	.05	9.8						
Cgs	19-30				8.0	4.42	52.8	0.23	—	—						

with iron. While the soil is weakly leached, it is frequently alkaline in reaction and may contain lime carbonate due to recharge with lime by periodic saturation with lime-charged ground water. The following profile description is representative of the Berlo fine sand soil:

L-H —1 to 0 inches, very dark greyish brown (10YR3/2, dry), leaf mat; neutral; grades through a clear, smooth boundary into:

Ah —0 to 2 inches, very dark grey (10YR3/1, dry), fine sand; weak fine crumb; very friable when moist, soft when dry; neutral; grades through a clear, smooth boundary into:

Aeg —2 to 4 inches, pale brown (10YR6/3, dry), fine sand; structureless; loose; neutral; iron stained; grades through a gradual, wavy boundary into:

Btgj—4 to 7 inches, dark greyish brown (10YR4/2, dry), loamy fine sand; weak fine crumb; very friable when moist, loose when dry; mildly alkaline; iron stained; grades through a gradual, irregular boundary into:

BC —7 to 9 inches, light brownish grey (10YR6/2, dry) fine sand; structureless; loose; moderately alkaline, calcareous; iron stained; grades through a gradual irregular boundary into:

Cg —9 to 24 inches, light grey (10YR7/2, dry) with mottles of brown (7.5YR5/4, dry); fine sand; structureless; loose when moist, weakly cemented when dry; moderately alkaline, strongly calcareous; strongly iron stained.

FIGURE 16

Soil profile of Berlo fine sand. A Gleyed Dark Grey Wooded developed on calcareous sandy deltaic sediments.
(Stick interval = 6 inches)

Mapping Units

Berlo series (2,892 acres)

Areas consisting dominantly of normal Berlo soils. Minor occluded areas are usually Berlo till substrate phase and Malonton soils.

Berlo till substrate phase (6,046 acres)

Areas of Berlo soils in which the strongly calcareous till substrate occurs within 30 inches of the surface. These areas have scattered surface stones.

Stonewall-Berlo complex (797 acres)—See Stonewall series.

Agriculture:

These soils are low in natural fertility and are subject to local flooding or water-logging during wet seasons. They are not well suited to grain production and are better used as hay and pasture land.

CHATFIELD COMPLEX

Areas of very poorly drained, Shallow Peat and Peaty Gleysol soils were mapped as Chatfield complex. These are soils that have a surface peat layer of 6 to 36 inches in thickness and are inundated for a major portion of the summer season. Inaccessibility of these areas prohibited additional separations based on thickness of peat or the nature of the underlying mineral material. Most of the areas of this soil complex occur within the Interlake Till Plain and the peat layer is underlain by calcareous till, water-worked till or thin lacustrine deposits over water-worked till. Areas occurring in the lacustrine plains have lacustrine silty and clayey sediments as the mineral substrate.

The areas of Chatfield soils are depressional to level and are covered with slough grasses, reeds and sedges. An occasional large boulder occurs on the surface and where the underlying mineral material is glacial till it is extremely stony. The peat layer varies from slightly acid to moderately alkaline, but usually contains lime carbonate carried in by runoff and seepage waters. Profile development under the peat is generally absent. Where the peat is relatively shallow, a thin Ahg horizon may have developed. The mineral material is strongly gleyed and strongly iron stained.

Mapping Units

Chatfield complex (174,753 acres)

Areas that are dominantly Chatfield soils but may contain minor occluded areas of

principally Deep Peat, Meleb and Fyala soils. Where areas of shallow peat soils have been drained and brought under cultivation they were mapped as Shallow Peat drained phase.

Garson-Chatfield complex (704 acres)—see Garson series.

Agriculture:

The Chatfield soils are nonarable unless artificially drained. In their natural condition they are of limited value for native hay and pasture due to prolonged inundation in normal years and to the poor quality of native forage. The soils differ in potential agricultural value with variation in the mineral material below the peat layer. However, the mineral soil is invariably strongly gleyed, low in organic matter and high in lime carbonate content. Artificial drainage of most areas of this soil is impractical due to the adjoining ridges which lay perpendicular to the general land slope.

CLARKLEIGH SERIES

The Clarkleigh series consists of poorly drained, variably saline Orthic Meadow soils developed on 4 to 15 inches of silty deltaic sediments over strongly calcareous till. The surface texture is dominantly silty clay loam with local areas of silty clay and clay. These soils occur in the south-western portion of the Interlake Till Plain and occupy the shallow depressions in the ridge and swale landscape of the Isafold association. They also occur in more continuous areas around the margin of the Shoal lakes and along the edge of the Marsh land adjacent to Lake Manitoba. The topography is level to depressional and the soils are wet for a considerable part of the summer. The native vegetation consists dominantly of meadow grasses and sedges with frequent patches of salt tolerant herbaceous and grass species. Some willows, black poplar and swamp birch occur at the margins of the areas. The Clarkleigh soils are moderately to very stony, depending on the depth of the lacustrine mantle over the very stony till.

The typical Clarkleigh soil profile consists of a thin, very dark grey Ah horizon that is silty clay loam and contains considerable muck. This layer fades gradually into an Ahg horizon of grey silty clay loam that usually extends down to the contact of the lacustrine sediments with the glacial till. The whole solum is iron stained, calcareous and usually saline. Snail shells are commonly found in the upper portion of the soil. The following is a representative profile description of the Clarkleigh silty clay loam soil:

Ah —0 to 6 inches, very dark grey (10YR3/1, dry), silty clay loam; weak fine granular; plastic and sticky when wet, friable when moist; moderately alkaline and calcareous; iron stained; grades through a diffuse, irregular boundary into:

Ahsg —6 to 12 inches, grey (10YR5/1, dry), silty clay loam; weak fine granular; plastic and sticky when wet, friable when moist; moderately alkaline and strongly calcareous; iron stained; contains gypsum crystals and salt pseudo-mycelium; grades through an abrupt, wavy boundary into:

IICsg1—12 to 17 inches, light greyish brown (2.5Y6/2, dry), clay loam till; weak fine pseudo-granular; plastic and slightly sticky when wet, friable when moist; moderately alkaline and strongly calcareous; iron stained; contains gypsum crystals and salt pseudo-mycelium; grades through a clear, irregular boundary into:

IICsg2—17 to 24 inches, light grey (10YR7/2, dry), clay loam till; weak fine pseudo-granular; plastic when wet, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained; contains gypsum crystals and salt pseudo-mycelium.

Mapping Units

Clarkleigh series (27,983 acres)

Areas consisting dominantly of Clarkleigh soils. Some areas may have minor occlusions of other kinds, principally Lundar and Marsh soils.

TABLE 9

Analysis of Clarkleigh Clay

Hor.	Depth inch	% Sand	% Silt	% Clay	pH	Cond. mmhos/ cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N
Ah	0-6	24.8	34.8	40.3	8.2	0.65	20.8	4.42	0.41	10.8
Ahsg	6-12	22.8	34.6	42.7	7.9	9.30	33.7	2.31	0.23	10.0
IICsg1	12-17	24.1	35.6	40.2	7.9	7.26	41.1	0.63	0.08	7.9
IICsg2	17-24	12.0	49.5	38.5	8.1	5.58	53.9	0.01	0.01	—

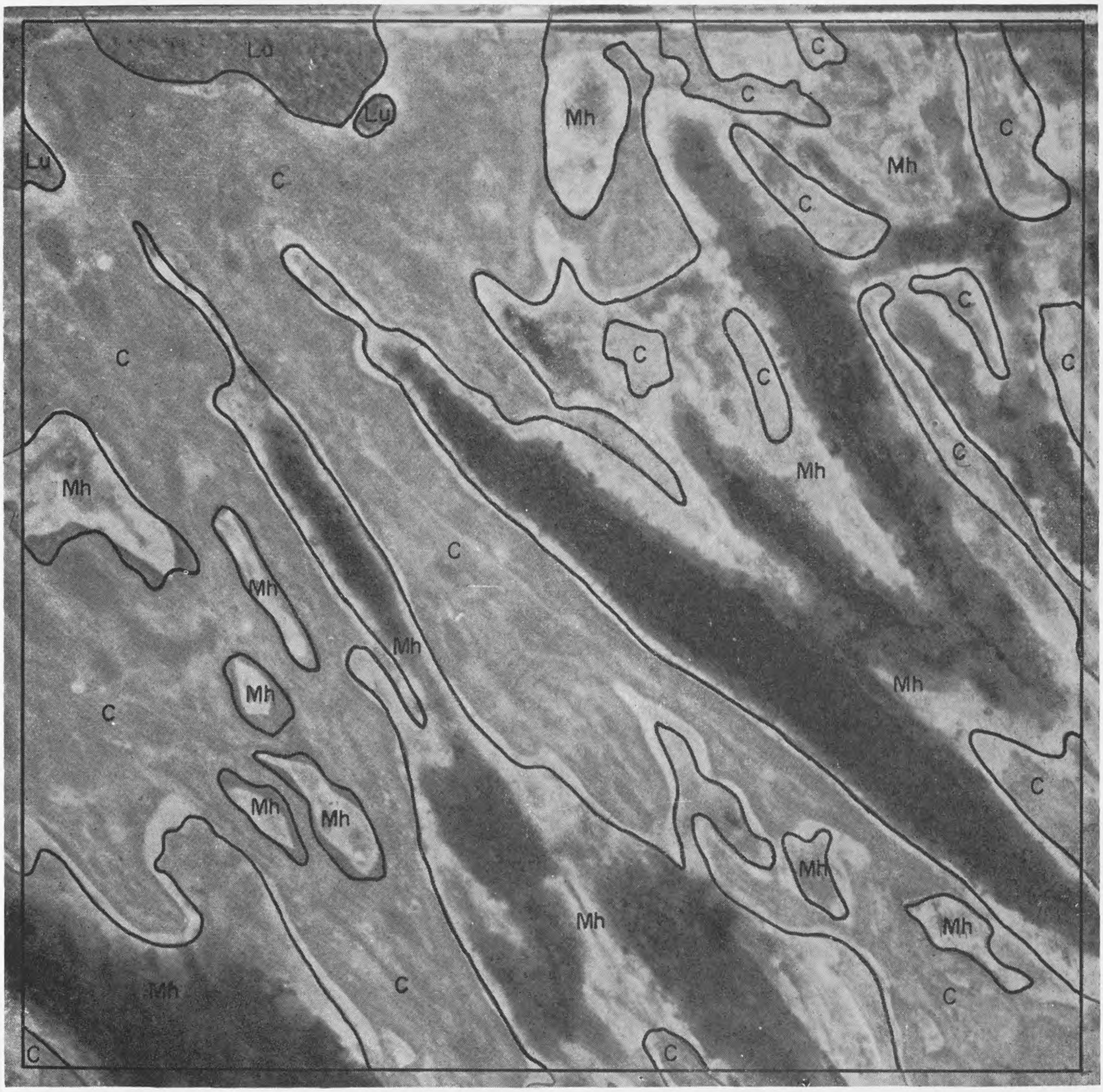


FIGURE 17

Detailed Soil Map of a Quarter Section within an area of Clarkleigh-Marsh complex. C = Clarkleigh series Mh = Marsh complex

Clarkleigh-Marsh complex (68,590 acres)

Areas in which Clarkleigh and Marsh soils occur in an intricate pattern in which individual soil areas are too small to be separated on the mapping scale used in this survey. These areas are level with micro-depressions, occupied by the Marsh soils, usually elongated in a north-west to south-east direction. The Clarkleigh soils are usually saline and thus have very few trees. On these soils the native vegetation

FIGURE 18

Area of Clarkleigh soils occurring in an elongated depression bordered by wooded Lundar soils.

consists primarily of salt tolerant grasses and herbs whereas on the associated Marsh soils the cover is mainly reeds and sedges. An example of the pattern in which these soils occur within the complex areas is given in Figure 17.

Isafold-Lundar-Clarkleigh complex (62,234 acres)—see Isafold series.

Lundar-Clarkleigh complex (105,115 acres)—see Lundar series.

Lundar-Clarkleigh-Marsh complex (82,350 acres)—see Lundar series.

Agriculture:

In their natural condition, the Clarkleigh soils are too wet for cultivation. Draining these soils for the purpose of grain production is not advisable, because of their salinity and liminess. Almost the entire area of these soils is being used for native hay production and grazing. Very little pasture improvement has been attempted. While the problems of bush cover and stones are not as great on these soils as on the better drained till soils, the problem of excess moisture normally prohibits the cultivation and growing of tame hay crops. Native forage growth is very slow in dry spring seasons. Local flooding and consequent inaccessibility of hay-land occurs in wet seasons. The native hay is mainly sedges and salt tolerant plants and is of low quality. Improvement in forage yields can be obtained by applications of phosphate and nitrogen fertilizers.

DEEP PEAT (42,832 acres)

Peat deposits over 36 inches thick were mapped as Deep Peat soils. No differentiation was made as to type of peat and nature of the underlying mineral materials due to inaccessibility of most of the areas at the time of mapping. Both fen and woody peats are known to occur. Most samples tested were slightly acid to medium acid in reaction. Deep Peat areas within the Interlake Till Plain are generally underlain by water-worked till deposits; while the peat deposits in the Washow Bay portion of the Icelandic River Lowland are usually underlain by lacustrine clay deposits. No areas of sphagnum are known to occur within these map areas, although some deposits do occur north of the Fisher map area near the west shore of Lake Winnipeg.

Agriculture:

Deep Peat areas are of no agricultural value in their natural state. Some areas can be drained and utilized as hay and pasture land or cultivated, after partial or complete peat removal, but the cost of reclamation is usually prohibitive. Thorough investigation into the nature of the underlying mineral material is a

necessary prerequisite in planning reclamation of Deep Peat areas for cultivation.

FISHER SERIES (2,688 acres)

The Fisher series consists of imperfectly drained, Gleyed Mull Regosols on moderately fine to fine textured alluvial deposits. These immature soils occur on flood plain and levee deposits of the Fisher and Icelandic rivers, mainly in the vicinity of Fisher Branch. They have smooth, very gently to gently sloping topography and, where not cultivated, are wooded with aspen, black poplar and willows. They are stone-free.

The soil profile development on these alluvial sediments is restricted to a thin, weakly expressed Ah horizon that grades sharply into the stratified parent material. The A horizon has fine granular structure, dark grey to very dark grey color, neutral to mildly alkaline reaction and may be weakly calcareous. The C horizon is strongly calcareous, weakly iron stained and may contain bands of darker material representing former surfaces which have been covered by recent deposition of fresh alluvium. Surface textures are usually silty clay and the underlying material varies from very fine sandy clay loam to silty clay.

Agriculture:

The Fisher soils, though very small in extent, are among the most fertile soils in the Fisher-Teulon map areas. They are suited to the production of grain and forage crops and will produce good yields in most seasons. The problem of liminess, which adversely affects the availability of phosphate to plants, can be minimized by the application of appropriate fertilizers. A lesser problem is a high water-table or flooding of the flats in very wet seasons.

FOLEY SERIES

The Foley series consists of poorly drained, Peaty Calcareous Meadow soils developed on strongly calcareous, medium to moderately coarse textured deltaic deposits. Surface textures are very fine sandy loam, loam and silt loam and subsurface textures generally become coarser with depth. Only a few small areas of this soil occur on the margins of the Red River and Fisher River plains. They are level to depressional and have very slow surface runoff. While the soils are very permeable, internal drainage is normally impeded by a high ground water-table. The native vegetation is meadow grasses and herbs with some clumps of willows, black poplar and aspen. The soils are mostly stone-free, with scattered surface stones occurring only in areas where the underlying glacial till comes close to the surface.

The Foley soils consist of a thin layer of fen peat underlain by a thin, very dark grey Ahg horizon that is iron stained, moderately alkaline and calcareous and has a weak crumb structure. The Cg horizon is light grey to pale yellow in color, very fine sand to silt loam in texture, iron stained, strongly calcareous and moderately alkaline. A representative profile description of this series is given below:

L-H—5 to 0 inches, very dark brown (10YR2/2, dry), fen peat; mildly to moderately alkaline and calcareous; grades through an abrupt, smooth boundary into:

Ahg—0 to 4 inches, very dark grey (10YR3/1, dry), very fine sandy loam; weak fine crumb; very friable when moist, soft when dry; moderately alkaline and calcareous; iron stained; grades through a clear, wavy boundary into:

Cgl —4 to 11 inches, light greyish brown (2.5Y6/2, dry), very fine sandy loam; weak fine pseudo-crumb; very friable when moist, soft when dry; moderately alkaline and strongly calcareous; iron stained; grades through a gradual, wavy boundary into:

Cg2—11 to 24 inches, pale yellow (2.5Y7/4, dry), very fine sand; structureless; very friable when moist, cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Foley series (1,243 acres)

Areas consisting dominantly of normal Foley soils. Minor occluded areas are mostly Foley till substrate phase soils in which a glacial till substrate occurs within 30 inches of the surface. No areas of the till substrate phase occur that are large enough to be mapped separately.

Agriculture:

The productivity of this soil is limited by poor drainage, high lime content and low fertility. Artificial drainage is required in all areas for the production of cultivated crops. The soils have thin Ah horizons and on cultivation the surface soil is mixed with the highly calcareous subsurface material—as indicated by the grey color of the plow layer. The soils are susceptible to wind erosion when they are drained and cultivated. Some areas are being used for native hay and pasturage.

FRAMNES SERIES

The Framnes series consists of imperfectly drained, Gleyed Dark Grey soils developed on a thin mantle of lacustrine clay over strongly calcareous silty deltaic deposits. The surface texture is clay. These soils occur in the Ice-

TABLE 10

Analysis of Foley Very Fine Sandy Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	5-0				7.6	0.71	16.8	13.19	1.16	11.38						
Ahg	0-4	58.7	27.0	14.3	8.0	0.59	23.0	3.28	0.33	9.85	19.9	9.6	9.9	0.1	0.3	—
Cg1	4-11	72.9	19.7	7.4	8.1	0.37	28.6	0.15	0.20	—						
Cg2	11-24				8.3	0.44	34.5	0.01	0.01	—						

landic and Fisher river plains, with the largest acreage located a few miles north of Arborg. The topography is smooth and level. Surface drainage is slow and permeability is moderately slow. The native vegetation is mixed spruce and aspen woods with some black poplar, hazel and willows. The soils are stone-free.

In their natural condition these soils have a thin, slightly acid leaf mat underlain by a very dark grey Ah horizon that may contain blotches of lighter colored, slightly leached material. This Ah horizon is 3 to 5 inches thick but frequently tongues down through the B horizon to a depth of 10 to 15 inches. The Btg horizon has a blocky structure and contains a slight clay accumulation. It is neutral to mildly alkaline in reaction and frequently contains free lime carbonate due to the seasonally high water table. The Btg horizon extends down to the contact of the clay mantle with the underlying silty material and the thickness of the solum varies with variation in the depth to the strongly calcareous substrate. A representative Framnes soil profile is described below:

L-H —2 to 0 inches, dark reddish brown (5YR3/2, dry), leaf mat; slightly acid; grades through a clear, smooth boundary into:

Ah —0 to 4 inches with tongues to 15 inches, very dark grey (10YR3/1, dry), clay; moderate fine granular; firm when moist, hard when dry; slightly acid; grades through a clear, irregular boundary into:

Btg —4 to 8 inches, greyish brown (10YR5/2, dry), clay; strong fine blocky; very firm when moist, very hard when dry; mildly alkaline and slightly calcareous; iron stained; grades through a clear, irregular boundary into:

IICkg—8 to 18 inches, light grey (2.5Y7/2 dry), silty clay; moderate medium pseudo-granular; friable when moist, strongly cemented when dry; moderately alkaline and strongly calcareous; iron stained; grades through a diffuse, irregular boundary into:

IICg —18 to 36 inches, pale yellow (2.5Y8/4, dry), silty clay; weak fine pseudo-crumb; friable when moist, strongly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Framnes series (11,883 acres)

Areas that are dominantly Framnes soils. Small occluded areas are mostly Peguis, Ledwyn, Tarno and Fyala soils.

Agriculture:

This is a moderately good agricultural soil suited to the production of grain and forage crops. The depth of the solum varies with the

TABLE 11

Analysis of Framnes Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
											Ca	Mg	Na	K	H
L-H	2-0				6.3	1.2	30.17	1.92	15.7						
Ah	0-4	9.3	34.7	56.0	6.3	0.0	5.46	0.41	13.3	54.7	28.4	22.3	0.2	1.1	4.3
Btg	4-8	5.3	35.3	59.4	7.4	13.8	1.66	0.16	10.4	37.3	21.8	17.4	0.2	1.1	
IICkg	8-18	7.3	43.8	48.9	8.1	44.5	0.87	0.07	12.4						
IICg	18-36	3.7	46.6	49.7	8.2	40.2	0.01	0.02	—						

TABLE 12

Analysis of Fyala Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	6-0				6.7	—	0.9	34.55	3.14	11.0						
Ah	0-2	6.9	20.7	72.4	6.7	—	0.6	5.26	0.45	11.7	49.9	38.1	7.4	0.4	1.2	2.5
Cg	2-7	7.3	14.1	78.6	7.4	0.30	3.5	0.95	0.03	29.7						
Ckg1	12-18				7.9	0.38	32.2	0.53	0.04	14.7						
Ckg2	18-24				7.9	0.42	36.8	0.48	0.02	30.0						

thickness of the clay mantle. Where the clay mantle is thin, the fertility is reduced by the high lime content of the underlying silty material. Local flooding and water-logging occur in wet years.

FYALA SERIES

The Fyala series consists of poorly drained Peaty Meadow soils developed on moderately calcareous lacustrine clay deposits. Surface texture of the cultivated soils is clay but usually contains a high percentage of peaty material that has been incorporated with the mineral soil. These soils are widespread throughout the lacustrine plains and the Winnipeg Lake Terrace area. They occupy level to depressional positions in the landscape and have slow surface runoff. Permeability is very slow and the soils are wet for a considerable portion of the summer. The native vegetation is meadow grasses and sedges with clumps of black poplar and willow. The soils are stone-free except for scattered stones on areas with a substrate of glacial till within 30 inches of the surface.

The virgin Fyala soils have a surface layer of fibrous peat and muck that is 3 to 12 inches thick and is underlain by a thin, very dark grey Ah horizon high in organic matter and neutral to mildly alkaline in reaction. The Ah horizon is normally 2 to 4 inches thick; in places it tongues down into the C horizon for several inches. The C horizon is olive grey when wet and contains iron concretions. A representative Fyala profile is described below:

L-H—6 to 0 inches, very dark brown (10YR2/2, dry), fibrous peat and muck; neutral; grades through a clear, wavy boundary into:

Ah —0 to 2 inches, very dark grey (10YR3/1, dry), clay; weak fine to medium granular; friable when moist, plastic and slightly sticky when wet; neutral; grades through a clear, wavy boundary into:

Cg —2 to 7 inches, light olive grey (5Y6/2, dry), clay; weak fine granular; firm when moist, plastic and sticky when wet; mildly alkaline and slightly calcareous; iron stained; grades through a gradual, wavy boundary into:

Ckg—7 to 36 inches, greyish brown (2.5Y5/2, dry), clay; massive, hard when dry, very plastic and sticky when wet; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Fyala series (68,540 acres)

Areas that are dominantly normal Fyala soils but may contain small occluded areas of principally Fyala till substrate phase, Osborne, Tarno, and Peguis soils.

Fyala till substrate phase (59,576 acres)

Areas of Fyala soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. Cultivated areas of these soils can usually be recognized by the presence of scattered surface stones. The till substrate is usually silty clay to clay in texture and has not appreciably affected the soil development in the overlying clay mantle.

Inwood-Fyala till substrate phase complex (1,178 acres)—see Inwood series.

Agriculture:

In their natural state, the Fyala soils are nonarable due to poor drainage. However, most of the larger areas of Fyala soils in these map areas have received some artificial drainage and are cultivated. In many areas the thin peat layer has been removed through fires or cultivation. Some cultivated soils still have a surface peat and muck layer or have a high percentage of organic material in the plow layer. Local flooding, water-logging and weeds are serious problems in crop production. Salinity is a problem in local areas. Soil

fertility is moderately low and the use of fertilizers for better yields is required. With improved drainage these soils are more suited to forage than grain production. In bringing new areas under cultivation it is highly desirable that the peat layer be incorporated with the mineral soil, which is naturally low in organic matter and of poor tilth.

GARSON SERIES

The Garson series consists of well to moderately well drained, Orthic Grey Wooded soils developed on strongly calcareous, very stony glacial till. Surface texture of the plow layer, which consists of a mixture of materials from the A, B and C horizons, is generally clay loam but ranges from sandy loam to clay. This wide range is due to the inclusion in the series of soils developed on a very thin (less than 6 inches) lacustrine mantle over the till. The soils of the Garson series occupy the higher till ridges and hillocks scattered throughout the Garson association portion of the Interlake Till Plain. The topography is irregular, very gently to gently sloping, commonly in the form of broad ridges. Surface runoff is moderate and permeability is medium. The vegetative cover of the virgin soils in the southern portion is mainly aspen with an intermingling of bur oak and in the northern portion the cover is white spruce and aspen. All Garson soils are very to exceedingly stony.

While the Garson soils have the profile characteristics typical of the Orthic Grey Wooded, the horizons are very thin. The entire solum is normally less than 10 inches thick, and in some places extends only 4 inches from the surface. In virgin sites, a thin, neutral to slightly acid leaf mat overlies a 1 to 3 inch light greyish brown Ae horizon that is neutral to slightly acid in reaction. The Bt horizon is well developed but very thin. It consists of 2 to 5 inches of brown to dark greyish brown, blocky structured aggregates. A thin BC transitional horizon usually separates the Bt from the highly calcareous C horizon. Cultivated Garson soils are neutral to mildly

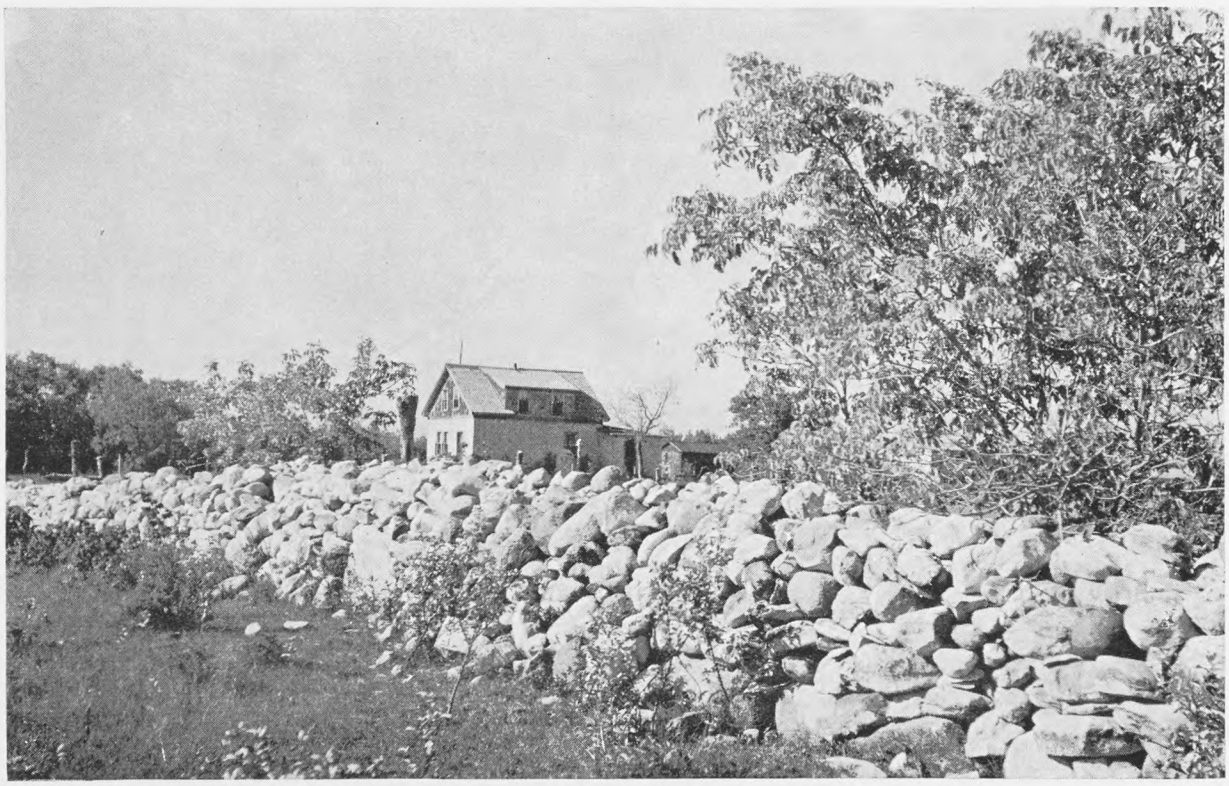


FIGURE 19

Fence made of piled stone taken from a cultivated field of Garson soils.

alkaline in the plow layer and often contain free lime carbonate. A representative, virgin Garson soil profile is described below:

L-H—1.5 to 0 inches, very dark greyish brown (10YR3/2, dry), leaf and sod mat containing much charcoal; neutral; grades through an abrupt, smooth boundary into:

Ae —0 to 2 inches, light greyish brown (10YR6/2, dry), sandy loam; weak fine granular; soft when dry, friable when moist; slightly acid; grades through a clear, smooth boundary into:

Bt —2 to 4 inches, dark greyish brown (10YR4/2, dry), sandy clay loam; moderate fine blocky, hard when dry, firm when moist; slightly acid; grades through a clear, smooth boundary into:

BC —4 to 7 inches, light brownish grey (10YR6/2, dry), loam; weak fine granular; hard when dry, firm when moist; plastic and sticky when wet; moderately alkaline and strongly calcareous; grades through a clear, irregular boundary into:

Ck —7 to 24 inches, light grey (10YR7/2, dry), stony clay loam till; weak fine pseudo-crumb; friable when moist, strongly cemented when dry; moderately alkaline and strongly calcareous.

Mapping Units

Garson series (91,004 acres)

Areas consisting dominantly of normal Garson soils. Minor occluded areas are mainly

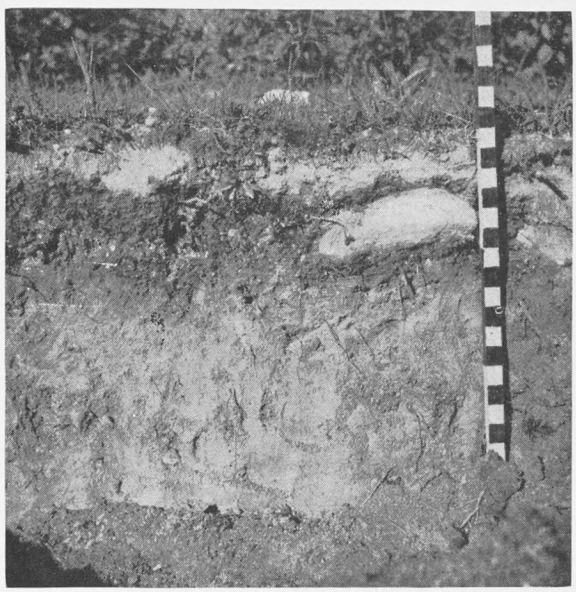


FIGURE 20

Soil profile of Garson loam. A thin Orthic Grey Wooded developed on very calcareous glacial till. (Stick interval = 1 inch)

TABLE 13

Analysis of Garson Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	1.5-0				6.8	0.37	1.4	28.84	1.83	15.8						
Ae	0-2	57.6	32.3	10.1	6.6	0.22	—	0.69	0.05	13.8	11.8	7.1	3.4	—	0.3	0.7
Bt	2-4	45.7	22.5	31.8	6.3	0.15	0.2	0.82	0.07	11.7	38.0	20.9	14.4	—	1.6	0.7
BC	4-7	40.6	35.6	23.8	7.5	0.31	29.8	1.11	0.12	9.3	15.8	13.4	6.9	0.1	0.6	—
Ck	7-24	31.7	38.8	29.5	7.9	0.27	53.8	0.38	0.04	9.5						

TABLE 14

Chemical Composition of Garson Clay Loam (In percentages of weight of soil after ignition)

Hor.	Depth	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	P_2O_5	MnO	SO_3	Total
Ae	0-2	76.16	11.47	2.93	.25	3.19	1.34	1.59	1.53	.11	.21	.01	98.79
Bt	2-5	66.78	18.83	4.13	.54	1.74	3.25	1.96	1.20	.08	.17	.04	98.72
BC	5-14	49.69	13.05	3.83	.42	16.61	12.74	1.55	0.89	.17	.17	.03	99.15
C1	14-28	47.99	11.38	3.34	.26	20.73	13.35	1.13	0.71	.10	.13	.03	99.15
C2	28-48	43.92	6.13	1.38	.21	27.75	16.98	.72	0.71	.07	.10	.03	98.00

Stonewall, Inwood and Garson rock substrate phase soils.

Garson-Chatfield complex (704 acres)

Areas of dominantly Garson soils but containing numerous sharp, elongated depressions occupied by very poorly drained soils of the Chatfield complex.

Garson-Narcisse complex (8,101 acres)

Areas in which Garson and Narcisse soils occur in a complex pattern, with no individual soil areas being large enough to warrant separation on the mapping scale used. Most areas of this soil complex occur between 5 and 10 miles south of Poplarfield. The limestone bedrock is close to the surface in these areas and the Narcisse soils occupy the portions of the areas in which the bedrock is within 30 inches of the surface. The areas have mixed vegetation with aspen and spruce on the Garson soils and grasses, low shrubs and herbs on the Narcisse soils. These areas are exceedingly stony.

Garson rock substrate phase (77 acres)

One small area in 33-24-3W was mapped as a rock substrate phase of the Garson series. This area consists of Grey Wooded soils developed on strongly calcareous till with a substrate of limestone bedrock within 30 inches of the surface. This soil is unusual in that most areas of thin till deposits over limestone bedrock have Black or weakly degraded soils developed on them. The Garson rock substrate phase soils are exceedingly stony.

Agriculture:

The land-use capability of these soils is severely limited by stoniness. The soils also are low in fertility due to the low nitrogen content, thinness of the solum and very high lime carbonate content of the C horizon. The very stony soils are limited in value for forestry as evidenced by the poor stand of aspen and white spruce which they support. Their use from an agricultural standpoint at present is mainly as pasture land, but the bush severely limits the carrying capacity. This capacity could be greatly increased if the woods were removed and the land seeded to grasses and legumes. To the present time, however, no method for tree removal and keeping the land free of trees has been devised that is sufficiently economical for land suitable only for pasture.

Some of the less stony land is under cultivation and is used for forage crops and to a very limited extent for grain production. In most years substantial increases in crop yields can be expected when either manure or phosphatic fertilizers are applied. Considerable success has been attained in the production of alfalfa seed especially on areas that lie adjacent to native woods.

HODGSON SERIES (1,792 acres)

The Hodgson series consists of moderately well drained, Mull Regosol soils on stratified alluvial deposits ranging in texture from very fine sand to silty clay loam. These soils occur on flood plain deposits bordering the Fisher River, mainly in the vicinity of Hodgson. The topography is smooth, gently sloping. Native vegetation is principally aspen, with some spruce, and a dense undergrowth of hazel, saskatoon, rose, etc. The soils are free of stones.

Soil profile development on these alluvial sediments is limited to a thin, weakly developed Ah horizon. This surface layer is 2 to 6 inches

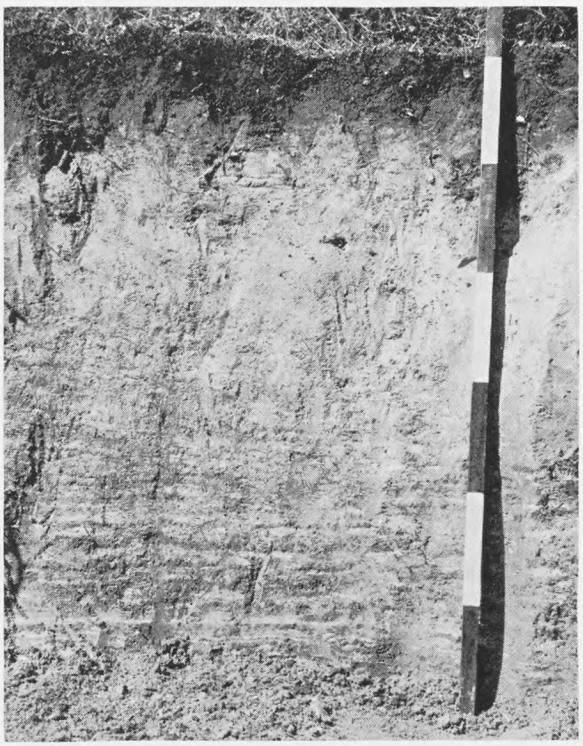


FIGURE 21

Soil profile of Hodgson loam. A Mull Regosol developed on moderately coarse to moderately fine textured alluvial deposits.
(Stick interval = 6 inches)

thick, dark grey, fine granular, friable, neutral to mildly alkaline in reaction and may contain lime carbonate. The underlying material is stratified, strongly calcareous and may contain dark colored bands representing some soil development on former surfaces.

Agriculture:

The Hodgson soils are moderately high in fertility and have no major problems in utilization for forage and grain production. The cultivated soils are moderately to strongly calcareous in the plow layer and should receive phosphate and nitrogen fertilization for maximum productivity.

INWOOD SERIES

The Inwood series consists of imperfectly drained, Gleyed Dark Grey soils developed on strongly calcareous till and water-worked till. Surface texture varies widely from fine sandy loam to clay because of the inclusion of soils with a thin lacustrine mantle (less than 6 inches) of moderately fine to fine textured sediments. These soils, together with the poorly drained Meleb soils, occupy the major portion of the Garson association area in the Interlake Till Plain. They occur on low, broad ridges and smooth, level terrain where surface runoff is slow and internal percolation is moderate to slow. The native vegetation is dominantly aspen, with some spruce and willow and a ground cover of meadow-prairie grasses and herbs. All the soils are stony, but the degree of stoniness varies with the presence and depth of the lacustrine mantle over the till.

The Inwood soils are characterized by a thin, blotched A horizon overlying a thin, weakly developed textural B horizon that grades sharply into very strongly calcareous till. The solum is generally less than 6 inches thick and, although the soil is slightly leached, the surface horizons are usually alkaline due to frequent recharge with carbonates from the limy ground water. The plow layer of cultivated soils contains a mixture of the A and B horizons with the strongly calcareous parent material and the surface appears grey when dry. A representative virgin profile is described below:

L-H—1 to 0 inches, very dark greyish brown (10YR3/2, dry), leaf and sod mat that contains a high percentage of charcoal from frequent ground fires; mildly alkaline; grades through an abrupt, smooth boundary into:

Ahe—0 to 2 inches, very dark grey (10YR3/1, dry) with blotches of grey (10YR5/1, dry), loam to clay loam; moderate fine granular; firm when moist, slightly hard when dry; mildly alkaline; grades through a clear, wavy boundary into:

FIGURE 22

Scrub aspen vegetation typical of areas of Inwood soils. Note stony soil surface in foreground.

FIGURE 23

Breaking on Inwood soils showing how limy subsoil is mixed with the surface layer.

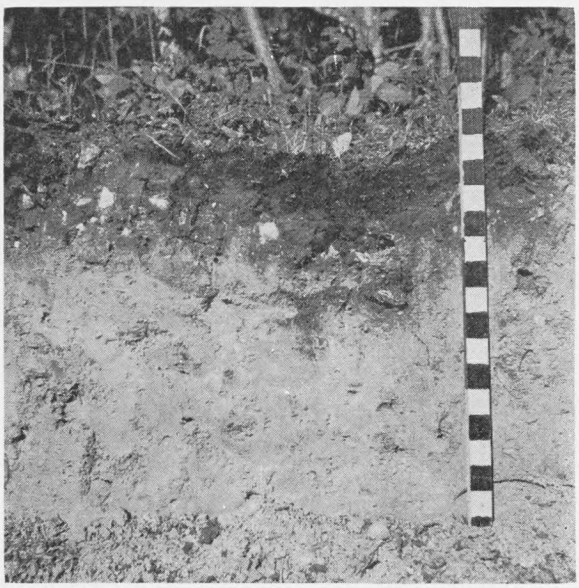


FIGURE 24

Soil profile of Inwood clay loam. A Gleyed Dark Grey developed on very calcareous glacial till. (Stick interval = 1 inch)

Bt —2 to 4 inches, greyish brown (10YR5/2, dry), clay loam; moderate fine blocky; firm when moist, hard when dry; mildly alkaline; grades through a clear, wavy boundary into:

BC —4 to 6 inches, light brownish grey (10YR6/2, dry), loam; weak fine granular; firm when moist, hard when dry; moderately alkaline and calcareous; iron stained; grades through a clear, wavy boundary into:

Ckg—6 to 24 inches, light grey (10YR7/2, dry), stony loam till; weak fine pseudo-granular; friable when moist, strongly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Inwood series (144,316 acres)

Areas consisting dominantly of Inwood soils. Minor occluded areas are principally: Stonewall, Meleb and Leary till substrate phase soils.

Inwood-Meleb complex (428,707 acres)

Very extensive areas in the Interlake Till Plain were mapped as this complex. They are areas of low ridge and swale topography in which the Inwood soils occupy the low, narrow ridges and the Meleb soils occur in the intervening depressions. These ridges and swales are elongated dominantly in a north-west to south-east direction and, in the areas mapped as this complex, they are too small to be shown separately on the soil maps.

Inwood-Narcisse complex (11,123 acres)

In areas mapped as this complex the limestone bedrock is close to the surface and is encountered within 30 inches at some locations. The Inwood soils occur on the deeper till deposits, where aspen and spruce trees exist in somewhat stunted forms, while the Narcisse soils have developed under grass vegetation on the shallow till and stratified drift deposits over rock. These areas are very to exceedingly stony.

Inwood-Fyala till substrate phase complex (1,178 acres)

Areas in which the depressions between the low, narrow till ridges contain a shallow deposit of lacustrine clay over the till. The Inwood soils occupy the ridges and the Fyala till substrate phase soils occur in the shallow depressions. This soil complex occurs in scattered locations in the Icelandic River Lowland, mainly in the vicinity of Washow Bay.

TABLE 15

Analysis of Inwood Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	1-0				7.4	0.53	8.5	23.69	1.35	17.6						
Ah	0-1	25.7	44.7	29.6	7.3	0.40	2.3	7.69	0.53	14.5	43.2	34.1	8.1	0.1	0.9	
Ahe	1-2	44.4	32.5	23.1	7.5	0.19	0.2	1.40	0.10	14.0	19.4	17.7	3.5	0.1	0.6	
Bt	2-4	40.3	26.8	32.9	7.3	0.18	1.1	1.06	0.08	13.3	26.6	19.9	6.1	0.2	0.4	
BC	4-6	42.4	36.7	20.9	7.6	0.30	28.5	0.78	0.09	8.7	16.9	13.0	3.6	0.1	0.5	
Ckg	6-24	31.6	44.6	23.8	8.0	0.29	55.3	0.39	0.04	10.0						

FIGURE 25

Area of Inwood-Narcisse soil complex showing the limestone bedrock close to the surface in the foreground with aspen and willow on Inwood soils in the background.

Agriculture:

There are many problems involved in the agricultural utilization of the Inwood soils. Principally they are very stony and thin soils of moderately low fertility and tend to become very calcareous at the surface when cultivated. In addition, they are subject to local flooding and water-logging during wet seasons. Their value as native pasture land is severely restricted by the dense growth of small aspen trees that covers all virgin sites. Areas of these soils that are being cultivated require continuous stone removal and the fields are usually dotted with stone piles or surrounded by piled stone fences. Nitrogen and phosphate fertilizers are required for good crop growth.

Most of the Inwood and Meleb soils are still covered with woods. Future utilization of this land will be a continuing problem. Work is required to develop economical methods of tree removal and grass seeding to improve the hay and pasture value of these thin, stony soils.

ISAFOLD SERIES

The Isafold series consists of well-drained and moderately well drained, Rego Black soils developed on strongly calcareous till and water-worked till. Surface textures vary widely, from sandy loam to clay, due to the inclusion of soils with a mantle of lacustrine sediments up to six inches thick over the clay loam to clay glacial till. These soils occupy the well-drained ridges and knolls in the Isafold association portion of the Interlake Till Plain. The topography is level to irregular, gently sloping. The soils were developed under mixed prairie grasses, but most virgin areas now support a semi-open stand of stunted aspen and bur oak. The Isafold soils are very stony and few areas can be cultivated without intensive stone removal.

The solum of the Isafold soils consists of an Ah horizon five to eight inches thick, very dark grey, granular, friable and mildly alkaline in reaction. It varies from sandy loam to clay in texture, but is dominantly clay loam. This surface horizon grades sharply into light grey to white glacial till. Stones occur throughout the soil. They are mainly limestone and dolostone fragments with some granitic stones and boulders. The following is a profile description of a representative Isafold clay loam soil:

Ah —0 to 7 inches, very dark grey (10YR3/1, dry), clay loam; strong fine to medium granular; slightly hard when dry, friable when moist; mildly alkaline, weakly calcareous in lower portion; grades through a clear, irregular boundary into:

FIGURE 26

Soil profile of Isafold clay loam. A Rego Black soil developed on very calcareous glacial till.
(Stick interval = 6 inches.)

AC —7 to 8 inches, light brownish grey (10YR6/2, dry), clay loam; moderate fine granular; slightly hard when dry, friable when moist; moderately alkaline, weakly calcareous; grades through a clear, irregular boundary into:

Ck1—8 to 14 inches, white (10YR8/2, dry), stony clay loam till; weak fine pseudo-granular; weakly cemented with carbonates when dry, friable when moist; strongly alkaline, strongly calcareous; grades through a diffuse, irregular boundary into:

Ck2—14 to 36 inches, light grey (10YR7/2, dry), stony clay loam till; weak fine pseudo-granular; strongly cemented with carbonates when dry, friable when moist; strongly alkaline, strongly calcareous.

Mapping Units

Isafold series (20,386 acres)

Areas consisting dominantly of normal Isafold soils. Minor occluded areas are usually Stonewall, Lundar or Clarkleigh soils.

Isafold rock substrate phase (2,442 acres)

Areas of Isafold soils in which limestone bedrock occurs within 30 inches of the surface. These areas have nearly level topography and are extremely stony. The native vegetation is strongly affected by the proximity of limestone to the surface. Trees are sparse and those that do occur are stunted and gnarled. Most areas of this soil are used as native pasture land.

Isafold-Lundar-Clarkleigh complex (62,234 acres)

Areas in which these three member series of the Isafold association occur in an intricate pattern in which individual soil areas are too small to be separated on this mapping scale. The Isafold soils occur on ridges that are generally elongated in a north-west to south-east direction. The ridges are separated by low swales occupied by Lundar and Clarkleigh soils. An example of the pattern in which these soils occur within the complex areas is given in Figure 27.

Agriculture:

Due to their extreme stoniness the Isafold soils are used chiefly as native pasture land. The carrying capacity of this native pasture is low and the forage is of poor quality. Where these soils are being cultivated the surface layer has become very limy, through mixing with subsoil material, and the productivity is lowered to a considerable extent. Applications of fertilizers containing nitrogen and phosphorus will substantially increase yields of grain and forage crops.

LAKELAND SERIES

The Lakeland series consists of imperectly drained, Gleyed Rego Black soils developed on

TABLE 16

Analysis of Isafold Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-6	33.5	32.4	34.1	7.3	0.32	1.8	8.6	0.84	10.3	52.58	34.58	15.57	0.20	1.09	—
Ck1	6-14	27.1	33.7	39.2	7.9	0.39	43.3	1.5	0.13	11.2						
Ck2	14-24	27.1	32.1	40.8	7.9	0.27	45.9	0.6	0.03	—						

TABLE 17

Chemical Composition of Isafold Clay Loam
(In percentages of weight of soil after ignition)

Hor.	Depth	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	P_2O_5	MnO	SO_3	Total
Ah	0-6	67.88	14.02	4.32	0.51	4.82	3.39	1.86	1.37	0.07	0.21	0.21	98.66
Ck1	6-14	43.41	17.41	2.85	0.36	21.31	11.19	1.41	1.00	0.10	0.13	0.07	99.24
Ck2	14-24	39.88	11.52	1.96	0.31	27.53	15.17	1.19	1.23	0.09	0.10	0.03	99.01

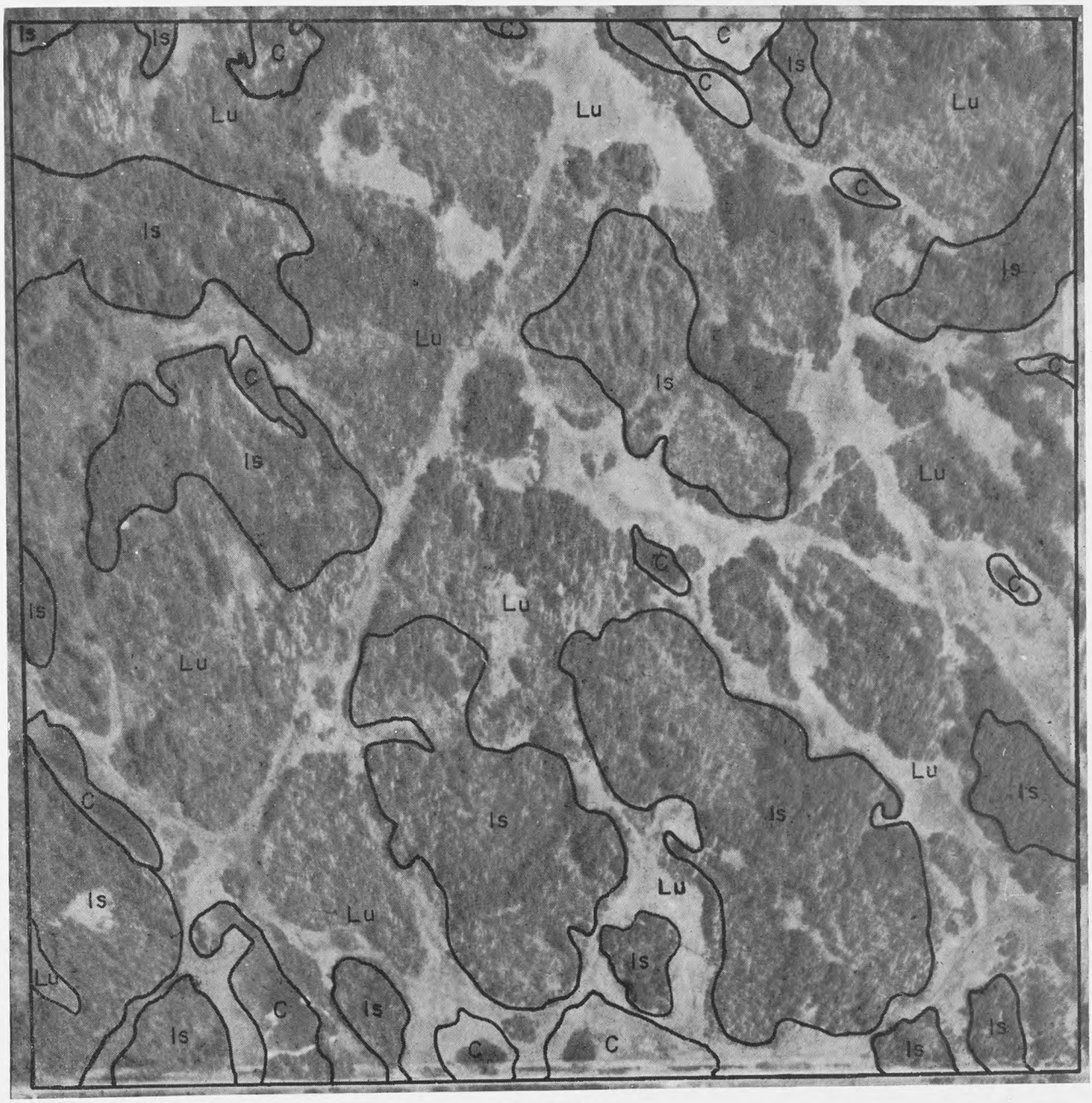


FIGURE 27

Detailed Soil Map of a Quarter Section in an area of Isafold-Lundar-Clarkleigh complex.
Is = Isafold series Lu = Lundar series C = Clarkleigh series

FIGURE 28
Cleared field in Isafold soil area showing extreme stoniness.

strongly calcareous, often stratified, deltaic deposits with textures ranging from loam to silty clay. The main area of these soils occurs along the western margin of the Red River Plain, at a slightly higher elevation than the adjoining, poorly drained Balmoral and Tarno soils. Smaller areas occur in the Fisher and Icelandic river plains and on the smaller delta west of Gimli. The topography is smooth, level to very gently sloping. Native vegetation was meadow-prairie grasses and herbs with some groves of aspen and willow. Runoff is slow and internal percolation is moderate to slow and impeded by a high water table during wet seasons. Surface stones are present only on the till substrate phase and are not a serious handicap to cultivation.

Profile development in the Lakeland soils has been strongly influenced by the high lime content of the parent material and imperfect drainage. The very dark grey Ah horizon is 5 to 10 inches thick, alkaline in reaction and calcareous in at least the lower portion. This surface horizon is separated from the parent material by a thin transitional layer that is moderately calcareous and contains a moderate amount of organic matter. These soils are clay loam to silty clay at the surface but commonly become coarser with depth, so that the C horizon may be in the loam to silt loam classes. A representative Lakeland clay loam soil profile is described on page 53.

FIGURE 29
Landscape view of Lakeland soils showing level topography and limy patches in a cultivated field.

Ah —0 to 5 inches, very dark grey (10YR3/1, dry), clay loam; moderate fine granular; friable when moist, slightly hard when dry; mildly alkaline and weakly calcareous; grades through a clear, smooth boundary into:

AC —5 to 10 inches, greyish brown (10YR5/2, dry), loam; weak fine granular; friable when moist, slightly plastic and sticky when wet; moderately alkaline and calcareous; grades through a clear, irregular boundary into:

Ckg1—10 to 16 inches, light grey (10YR7/2, dry), silt loam; weak fine pseudo-granular; friable when moist, plastic and very sticky when wet; moderately alkaline and strongly calcareous; iron stained; grades through a diffuse, irregular boundary into:

Ckg2—16 to 22 inches, very pale brown (10YR7/3, dry), silt loam; weak fine pseudo-granular; friable when moist, cemented when dry, plastic and very sticky when wet; moderately alkaline and strongly calcareous; iron stained.

Cg —22 to 36 inches, very pale brown (10YR7/4, dry), silt loam; weak fine pseudo-granular; friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Lakeland series (20,600 acres)

Areas consisting dominantly of normal Lakeland soils. Small occluded areas are principally Balmoral, Plum Ridge and Lakeland till substrate phase soils.

Lakeland till substrate phase (2,206 acres)

Areas of Lakeland soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. These soils are usually recognizable by the presence of scattered small stones on the surface. A thin gravel or cobble lens may occur at the contact of the two materials. The till substrate is similar in texture and lime content to the overlying deltaic sediments, but is usually more compact and may impede internal percolation.

FIGURE 30

Soil profile of Lakeland clay loam. A Gleyed Rego Black developed on very calcareous silty deltaic deposits. (Stick interval = 6 inches)

Agriculture:

The Lakeland soils are moderately high in productivity for grain, forage and most regional intertilled crops. The calcareousness of the soil has a detrimental affect on phosphorus availability and most crops will show marked response to phosphate and nitrogen fertilizers. In most areas surface drainage has been improved by the installation of open ditches, but water-logging is still a hazard in excessively wet seasons. Unprotected fields are susceptible to loss of top soil by wind erosion and this is particularly damaging to these naturally thin soils with strongly calcareous subsoils.

TABLE 18

Analysis of Lakeland Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-5	24.5	45.1	30.3	7.5	0.71	5.4	6.95	0.56	12.4	43.2	23.7	18.3	0.4	0.8	—
AC	5-10	35.6	39.4	25.0	7.9	0.42	13.5	0.95	0.11	8.6	21.3					
Ckg1	10-16				8.2	0.38	58.9	0.32	0.03	10.7						
Ckg2	16-22	6.6	70.0	23.5	8.2	0.37	58.3	0.13	0.02							
Cg	22-36				8.2	0.35	55.7	0.07	0.02							

LEARY COMPLEX

The Leary complex consists of well to excessively drained, Dark Grey and Dark Grey Wooded soils developed on coarse sand and gravel beach, outwash and stratified drift deposits. There is commonly a thin sandy surface mantle over the coarser material and surface textures range from loamy fine sand to sand. These soils occur throughout the map areas but are most common on the beach ridges bordering the lacustrine plains. The topography is smooth, very gently to gently sloping, mostly in the form of low, narrow ridges. There is little surface runoff as the soils are very permeable and the rainfall enters and percolates through the soil very rapidly. Water-holding capacity is low. Native vegetation is variable. While most areas appear to have been covered by prairie grasses until relatively recent times they are now wooded with semi-open stands consisting mainly of aspen mixed with some bur oak and white spruce. The oak is more common in the southern portion and spruce becomes prevalent to the north. These gravelly soils have few surface stones.

All Leary soils show some leaching under woods, but the degree of degradation varies within small areas. Dark Grey soils with dark grey A horizons and weakly developed textural B horizons occur intermixed with Dark Grey Wooded soils having thin, greyish brown Ae horizons and better developed illuvial B horizons. The soil profiles are commonly developed partially in the surface sandy mantle and partly in the underlying coarse sand and gravel. A representative Dark Grey soil profile of the Leary complex is described below:

L-H—2 to 0 inches, dark reddish brown (5YR2/2, dry) leaf mat consisting mainly of partially decomposed aspen leaves; slightly acid; grades through an abrupt, smooth boundary into:

Ah1—0 to 4 inches, very dark brown (10YR2/2, dry), loamy coarse sand; structureless; loose when moist, slightly hard when dry; slightly acid; grades through a gradual, irregular boundary into:

Ah2—4 to 6 inches, dark brown (10YR3/4, dry), coarse sand; structureless; loose when moist; weakly cemented when dry; slightly acid; grades through a clear, irregular boundary into:

Bt —6 to 11 inches, dark yellowish brown (10YR4/4, dry), loamy coarse sand; weak medium granular; very friable when moist, weakly cemented when dry; slightly acid; grades through a gradual, irregular boundary into:

BC —11 to 15 inches, brown (10YR4/3, dry), coarse sand and gravel; structureless; loose when moist, weakly cemented when dry; mildly alkaline and slightly calcareous; grades through a gradual, irregular boundary into:

C —15 to 36 inches, pale brown (10YR6/3, dry), coarse sand and gravel; structureless; loose; moderately alkaline and calcareous.

Mapping Units

Leary complex (22,203 acres)

Areas consisting dominantly of normal Leary soils. These areas are mostly quite distinct and rarely include areas of other soils. Some Agassiz and Leary till substrate phase soils may occur within some areas mapped as Leary soils.

Leary till substrate phase (17,443 acres)

Areas of Leary soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. These soils occur on thin outwash and beach deposits bordering the beach ridges and at scattered locations in the Interlake Till Plain. The substrate of loam to clay loam textured till impedes internal percolation rendering these soils less arid than the normal Leary soils.

Agriculture;

The Leary soils are unsuitable for grain production, but in some areas are used for this purpose. They are low in organic matter and available plant nutrients and have a very low moisture retention capacity. Areas that are cultivated should be sown to drought-tolerant grasses and used for pasture. This use is made of the virgin areas and others that were formerly under cultivation. Many of the thicker gravel deposits are being used as a source of gravel for road construction.

LEDWYN SERIES

The Ledwyn series consists of imperfectly drained, Gleyed Dark Grey soils developed on strongly calcareous, medium to moderately fine deltaic sediments. Surface textures range from very fine sandy loam to silty clay loam and the soils commonly become slightly coarser with depth and are often stratified with layers of very fine sand. This is a minor soil in the map areas and occurs in the southern portion of the Fisher River Plain and in the small deltaic area west of Gimli. The topography is smooth and level. Runoff is slow and internal drainage is medium to moderately rapid but may be impeded by a high water table. The virgin soils are wooded with aspen and occasional spruce. The soils are free of stones.

The Ledwyn soils are weakly degraded. They have a thin dark grey A horizon that

may be blotched with grey patches in the lower portion. The B horizon has a slight clay accumulation and is iron stained. The solum is generally less than 10 inches thick. Occasional flooding by lime-charged water causes these soils, in many areas, to be mildly alkaline to the surface and some to be limy in the A and B horizons. A representative profile of Ledwyn clay loam is described below:

L-H —1 to 0 inches, very dark brown (10YR2/2, dry), leaf mat of partially decomposed aspen leaves; mildly alkaline; grades through an abrupt, smooth boundary into:

Ahej—0 to 3 inches, very dark grey (10YR3/1, dry), with blotches of grey (10YR5/1, dry), clay loam; moderate fine granular; friable when moist, slightly hard when dry; mildly alkaline; grades through a gradual, smooth boundary into:

Btg —3 to 6 inches, greyish brown (10YR5/2, dry), silty clay loam; moderate fine granular; friable when moist, slightly hard when dry; mildly alkaline; iron stained; grades through a gradual, smooth boundary into:

BC —6 to 9 inches, light brownish grey (2.5Y6/2, dry), silty clay loam; weak fine crumb; friable when moist, slightly hard when dry; moderately alkaline and calcareous; iron stained; grades through a gradual, smooth boundary into:

Cg —9 to 36 inches, light grey (2.5Y7/2, dry), stratified very fine sandy loam to silty clay loam; weak fine pseudo-crumb; friable to very friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Ledwyn series (3,044 acres)

Areas that are dominantly Ledwyn soils. Occluded minor soils are principally Lakeland, Balmoral, Tarno and Framnes soils.

Agriculture:

The Ledwyn soils are very thin and cultivation usually results in the mixing of strongly calcareous parent material with the surface horizons. This is detrimental to the fertility of the soils and should be kept to a minimum through shallow cultivation. These soils require nitrogen and phosphate fertilizers and are more suited to forage than grain production. Most areas are subject to water-logging and local flooding during very wet seasons.

LUNDAR SERIES

The Lundar series consists of imperfectly drained, Gleyed Rego Black soils developed on strongly calcareous till and water-worked till. In most areas the Lundar soils have a very thin mantle of lacustrine sediments over the till and the underlying till commonly contains bands and pockets of less calcareous, clay sediments. The surface texture is usually silty clay loam or silty clay but clay textures are not uncommon. These soils occupy the lower ridges and knolls in the Isafold association portion of the Interlake Till Plain. The topography is smooth, level to gently sloping. Native vegetation appears to be undergoing a change from grass to aspen, black poplar and willow, with some areas wooded and others under native meadow-prairie grasses. Silverberry, snowberry and swamp birch are common shrubs. The Lundar soils are generally less stony than the Isafold and Stonewall soils, due to the thin lacustrine surface mantle, but stones are still a major problem to cultivation.

The Lundar soils consist of a thin, very dark grey A horizon grading directly into the gleyed, strongly calcareous parent material. The A horizon is moderately alkaline and contains considerable lime carbonate. There is an irregular, gradual fading out of organic matter into the C horizon and some tongues of A horizon extend a few inches into the light grey parent material. A representative Lundar profile is described on page 57.

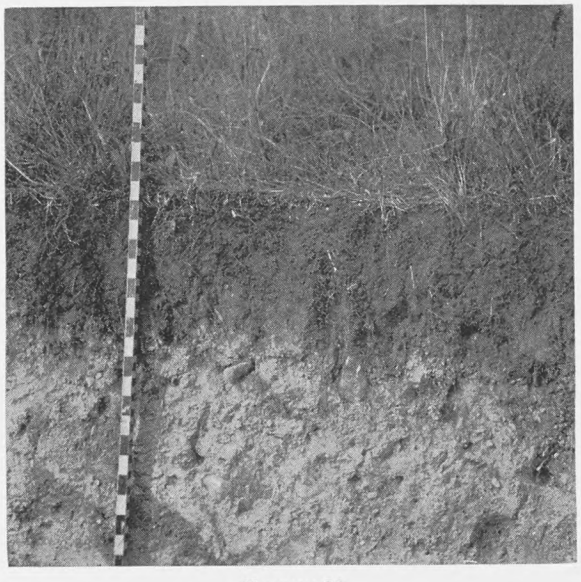


FIGURE 31

Soil profile of Lundar clay loam. A Gleyed Rego Black soil developed on very calcareous till.

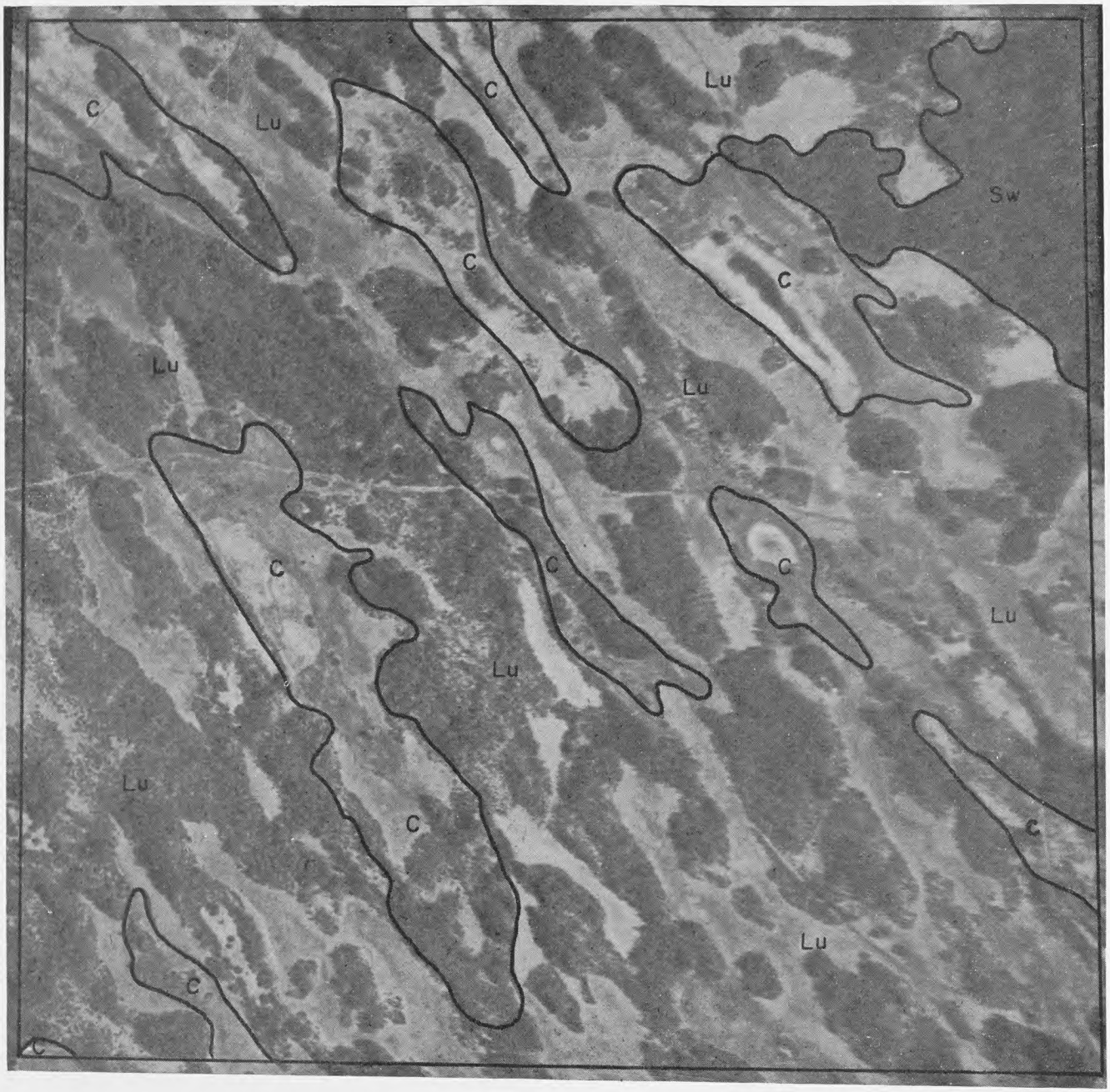


FIGURE 32

Detailed Soil Map of a Quarter Section in an area of Lundar-Clarkleigh complex.
Lu = Lundar series C = Clarkleigh series

TABLE 19
Analysis of Lundar Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-5	28.9	27.0	44.0	7.6	0.41	13.2	5.98	0.61	9.8	36.1	17.9	16.6	0.2	1.4	—
AC	5-11	24.4	31.8	43.8	8.1	0.48	37.8	1.89	0.19	9.9						
Ckg	11-24	22.5	34.9	42.6	8.3	0.36	40.0	0.51	0.05	10.2						

Ah —0 to 5 inches, very dark grey (10YR3/1, dry), light clay (heavy clay loam); moderate fine granular; firm when dry, slightly hard when moist; mildly alkaline and calcareous; grades through a diffuse, irregular boundary into:

AC —5 to 11 inches, greyish brown (10YR5/2, dry), light clay (heavy clay loam); weak fine granular; firm when moist, slightly hard when dry, plastic and sticky when wet; moderately alkaline and strongly calcareous; iron stained; grades through a gradual, irregular boundary into:

Ckg—11 to 24 inches, blotched light grey (2.5Y7/2, dry) clay and white (2.5Y8/2, dry) clay loam till; fine pseudo-crumb; plastic and very sticky when wet, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Lundar series (10,765 acres)

Areas consisting dominantly of Lundar soils. Minor occluded areas are principally Clarkleigh, Isafold and Marsh soils. Some areas of Lundar soils contain local saline patches.

Lundar-Clarkleigh complex (105,115 acres)

Areas containing significant proportions of both Lundar and Clarkleigh soils in which individual soil areas are too small to be shown on the soil map. Within these areas the Lundar soils occupy the low, narrow ridges and the Clarkleigh soils occur in the intervening depressions. An example of the distribution of these soils within the complex areas is shown in Figure 32.

Lundar-Clarkleigh-Marsh complex (82,350 acres)

Areas containing significant proportions of each of Lundar, Clarkleigh and Marsh soils in

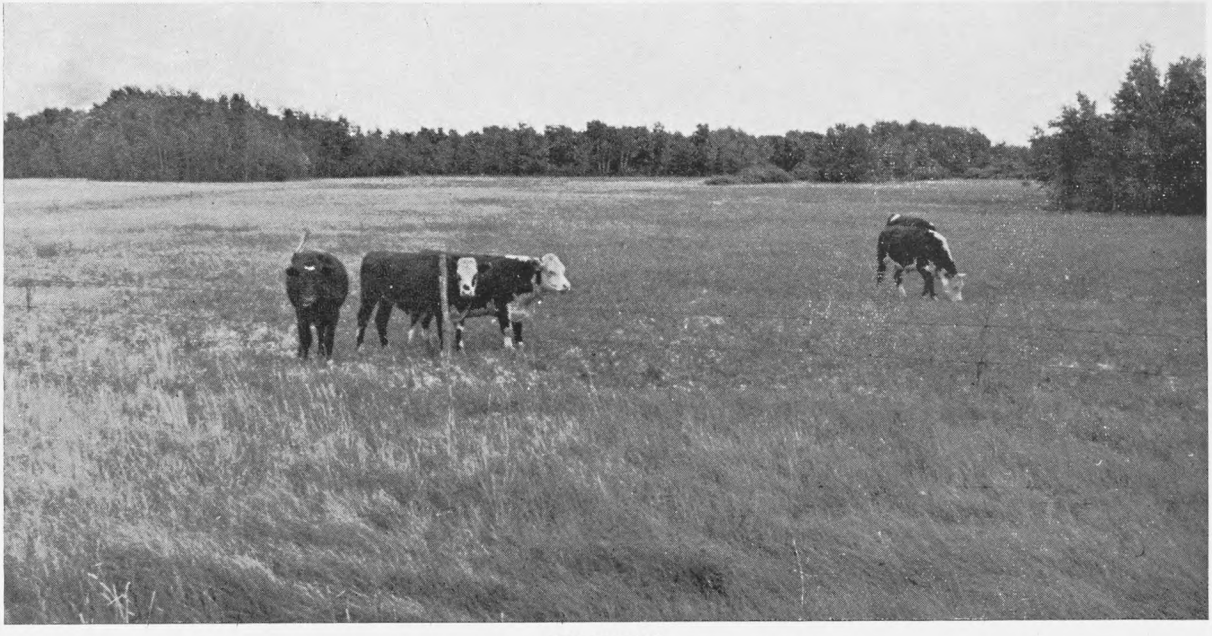


FIGURE 33
Landscape view of native pasture on Lundar-Clarkleigh soil complex.

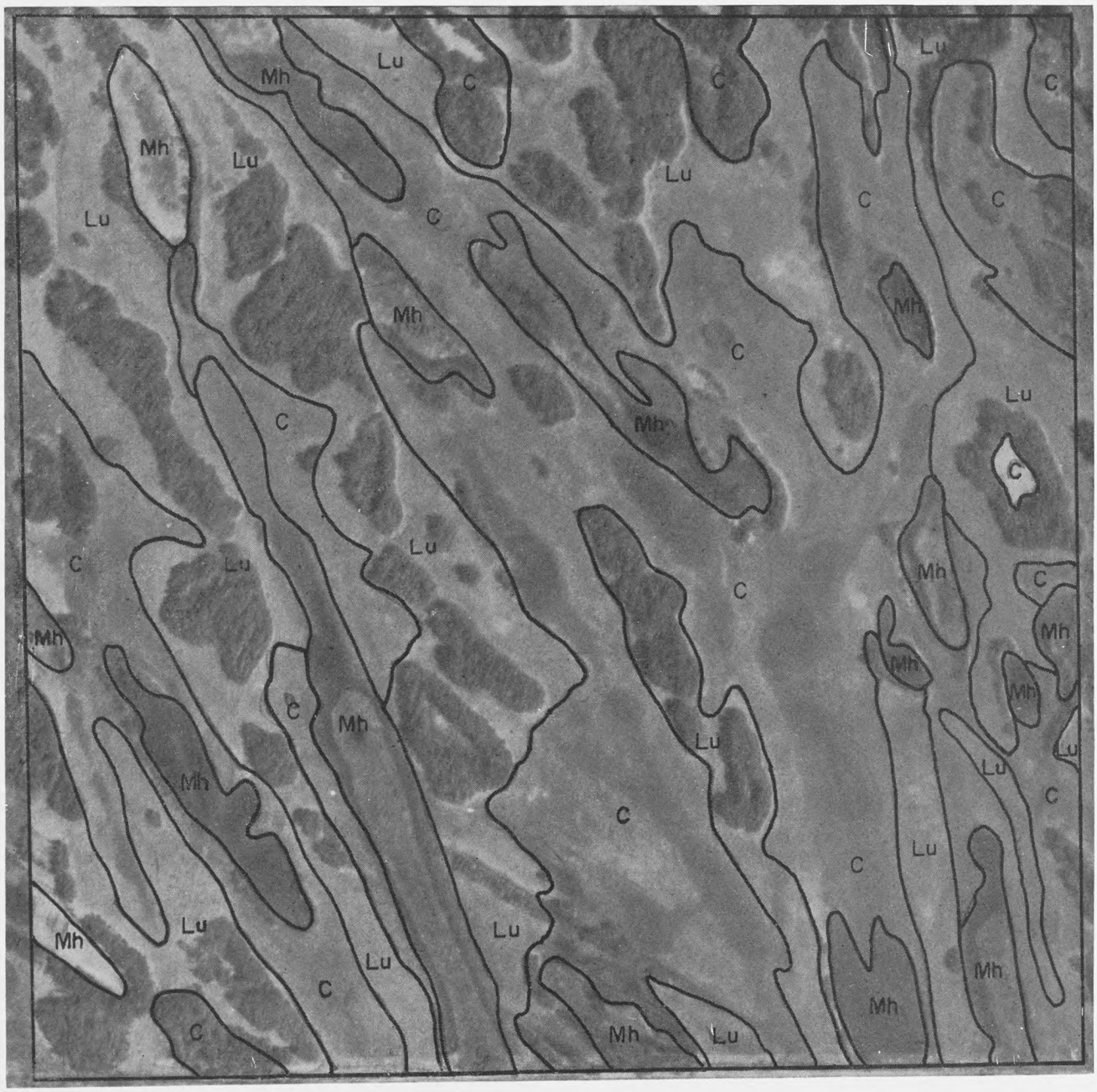


FIGURE 34

Detailed Soil Survey of a Quarter Section in an area of Lundar-Clarkleigh-Marsh complex.
Lu = Lundar series C = Clarkleigh series Mh = Marsh complex

which individual soil areas are too small to be shown on the soil map. These areas are distinguished from the Lundar-Clarkleigh complex areas by the presence of numerous enclosed depressions containing very poorly drained Marsh soils. An example of the distribution of these soils within the complex areas is shown in Figure 34.

Isafold-Lundar-Clarkleigh complex (62,234 acres)—see Isafold series.

Agriculture:

The Lundar soils have many features that hinder successful agricultural utilization. They are thin stony soils with a very high content of lime carbonate in the parent material and moderate amounts in the A horizon. The parent material is commonly saline and the soluble salts periodically rise to the surface by capillary action. The soils are subject to local flooding and waterlogging in wet seasons, and in dry seasons the native hay or cultivated crops are severely affected by physiological drought. The distribution of these soils in small areas interspersed with poorly and very poorly drained areas further restricts their use due to inaccessibility in wet seasons and lack of many areas of sufficient size to warrant treating separately from the poorer Clarkleigh and Marsh soils.

Most of the total area of Lundar, Clarkleigh and Marsh soils is being used as native pasture land. The carrying capacity is low and the native pasture is of poor quality. Utilization through extensive grazing and hay making, and the predominant small land holdings have prohibited large expenditures of capital on pasture improvement. Where economically possible the carrying capacity could be increased substantially by eradication of the scrub aspen and willow bush and fertilization of the grass. A few areas have been broken for the production of grain crops but the low fertility of these soils has resulted in poor yields. Cultivation is difficult due to the stoniness of these soils and it results in lowered fertility through mixing of the very strongly calcareous parent material with the surface soil.

MALONTON SERIES

The Malonton series consists of poorly drained, Peaty Calcareous Meadow soils developed on strongly calcareous, sandy deltaic and outwash deposits. In their natural state these soils have a surface peat layer of 3 to 12 inches in thickness. Below this, the upper mineral soil is sand to fine sandy loam in texture. The Malonton soils, of which the till substrate phase is the more common, occur in small areas near the eastern margin of the Interlake Till Plain. The topography is irregular, level to depressional and soil drainage is poor due to lack of surface runoff and impeded internal drainage. The ground water table is at or near the surface for a considerable part of the summer season. Native vegetation is dominantly meadow and slough grasses, sedges and reeds. Some clumps of willow and scattered groves of black poplar occur in some areas. Scattered surface stones and an occasional boulder occur on the till substrate phase.

In virgin Malonton soils, a very dark grey, alkaline and calcareous A horizon of variable thickness underlies the surface layer of fen peat. This A horizon tends to be thinnest where the peat layer is thickest, but is generally within the range of 2 to 5 inches. The underlying C horizon is strongly mottled with iron and is strongly calcareous. A substrate of very

TABLE 20

Analysis of Malonton Fine Sandy Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	5-0				6.2	—	2.6	39.86	1.50	26.6						
Ahg	0-3	72.5	16.0	11.5	7.8	0.40	11.6	4.75	0.33	14.4	29.3	21.2	7.9	0.1	0.1	—
Cg1	3-12	78.6	13.1	8.2	8.2	0.34	27.6	0.45	0.04	11.3						
Cg2	12-24	87.7	9.4	2.8	8.3	0.24	30.6	0.17	0.01	17.0						

strongly calcareous till occurs at variable depths. A representative Malonton soil profile is described below:

L-H—5 to 0 inches, dark reddish brown (5YR2/2, dry), fen peat; slightly acid; grades through a clear, smooth boundary into:

Ahg—0 to 3 inches, very dark grey (10YR3/1, dry), fine sandy loam; structureless; very friable when moist, soft when dry; moderately alkaline and calcareous; iron stained; grades through a gradual, smooth boundary into:

Cg1—3 to 12 inches, light grey (2.5Y7/2, dry), loamy fine sand; structureless; loose; moderately alkaline and strongly calcareous; iron stained; grades through a clear, smooth boundary into:

Cg2—12 to 24 inches, pale yellow (2.5Y8/4, dry) with mottles of brownish yellow (10YR6/6, dry), fine sand; structureless; loose; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Malonton series (977 acres)

Areas consisting dominantly of normal Malonton soils. Small occluded areas are principally Malonton till substrate and Foley soils.

Malonton till substrate phase (2,269 acres)

Areas of Malonton soils in which the strongly calcareous till substrate occurs dominantly within 30 inches of the surface. These areas have irregular, level topography and the depth to the till substrate may vary considerably within short distances. The till substrate in these and normal Malonton soils impedes internal drainage and causes the high moisture regime that has produced this Peaty Meadow soil.

Agriculture:

The Malonton soils occupy small depressed areas enclosed by till ridges and artificial improvement of drainage is usually not feasible. In their natural state, these soils are better suited for hay production or use as native pasture land than for grain production. They are low in available plant nutrients and most crops will likely respond to applications of fertilizers.

MARSH COMPLEX

The Marsh complex consists of very poorly drained, Orthic Gleysol soils. These weakly developed soils occur on land that has been covered with water until recent times and is still saturated for most of the year. In these map areas, they occur on low-lying land at the margins of lakes Manitoba and Winnipeg and surrounding the Shoal lakes, and in some enclosed depressions in the south-west portion of the Interlake Till Plain. The topography is depressional to level and the native vegetation consists entirely of rushes, reeds and sedges. There are scattered surface boulders in some areas and the subsoil is often very stony.

The areas mapped as Marsh complex were not differentiated as to the nature of the mineral soil. Most of the areas along the shore of Lake Manitoba and surrounding the Shoal lakes consist of very strongly calcareous, water-worked till that is usually silty clay to clay in texture. The areas bordering Lake Winnipeg consist dominantly of silty lacustrine deposits and thin lacustrine deposits over till. The soils have a thin surface layer of muck, or mineral material high in muck content, underlain by strongly gleyed, olive grey mineral material. A very thin A horizon of less than 1 inch may be present below the muck surface layer. A representative profile of a Marsh soil developed on water-worked till is described below:

F-H—3 to 0 inches, black (10YR2/1, moist), muck; mildly alkaline and calcareous; grades through a clear, smooth boundary into:

Ahg—0 to 1 inch, black (5Y2/1, moist), silty clay; weak fine granular; very plastic and very sticky when wet, friable when moist; moderately alkaline and calcareous; iron stained; grades through a clear, smooth boundary into:

Cg —1 to 24 inches, grey (5Y5/1, moist), with mottles of light grey (5Y7/1), dark grey (5Y4/1) and strong brown (7.5YR5/8), silty clay till; weak fine pseudo-granular; very plastic and very sticky when wet, strongly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Marsh complex (75,806 acres)

Areas consisting dominantly of Marsh soils. These areas are level to depressional and are mostly quite uniform with very few occluded areas of other soils.

Marsh-Saline Flats complex (11,104 acres)

Areas that occur principally in the vicinity of the Shoal lakes and bordering Dog Lake consisting of intermingled small areas of Marsh and Saline Flats soils. The Saline Flats are largely bare of vegetation and have a white encrustation of salts when the surface is dry. The adjoining areas of Marsh soils also contain soluble salts but in lesser quantities and are supporting a growth of reeds and sedges.

TABLE 21

Analysis of Meleb Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/ cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N
L-H	4-0				7.1	0.78	5.4	37.34	2.72	13.72
Ahg	0-5	37.6	45.0	17.4	7.7	0.68	37.8	5.70	0.54	10.65
Ckg1	5-12	8.0	60.9	31.1	8.0	0.39	63.2	0.75	0.05	14.42
Ckg2	12-24	9.1	54.1	36.9	8.1	0.39	69.5	0.32	0.00	—

Lundar-Clarkleigh-Marsh complex (82,350 acres)—see Lundar series.

Clarkleigh-Marsh complex (71,428 acres)—see Clarkleigh series.

Agriculture:

The Marsh soils are of very low agricultural value. Some areas are being used periodically as native hay and pasture land, but in most seasons the land is too wet for these purposes. The native hay from these soils is of very poor quality. Some areas bordering the larger lakes provide recreational grounds for duck and geese hunting and are used extensively for this purpose.

MELEB SERIES

The Meleb series consists of poorly drained, Peaty Calcareous Meadow soils developed on strongly calcareous till and water-worked till. Surface textures, under the thin peat covering, vary from sandy loam to clay due to the inclusion of soils developed on a very thin mantle (less than 6 inches) of lacustrine sediments over till and soils developed in the loam to clay loam till. These soils are the most extensive kind in the map areas. They occur throughout the Garson association portion of the Interlake Till Plain, occupying the swales in areas of low ridge and swale topography and the larger areas of flat, poorly drained land surrounding bogs and small lakes. The native vegetation is dominantly meadow grasses, sedges and herbs, but extensive areas are covered with willows, black poplar and some aspen. While these soils all contain sufficient stones to hinder cultivation, some areas are less stony than others. The areas that have a thin mantle of lacustrine sediments over the till are the least stony and this has encouraged some cultivation.

In their natural condition the Meleb soils consist of a thin layer of fen peat overlying a thin, dark grey A horizon that is alkaline and calcareous. In many places the A horizon tongues into the light grey to white, very strongly calcareous till. In the soils with a thin lacustrine mantle over the till, the A horizon usually ends at the contact of the two materials. The mantle varies from sandy loam to clay in texture and a gravel or cobble lens commonly occurs at the junction with the loam to clay loam till. A representative profile of Meleb loam is described below:

L-H —4 to 0 inches, black (10YR2/1, dry), fen peat and muck; neutral; grades through an abrupt, smooth boundary into:

Ahg —0 to 5 inches, dark grey (10YR4/1, dry), loam; weak fine crumb; friable when moist, plastic and slightly sticky when wet; moderately alkaline and strongly calcareous; grades through a clear, irregular boundary into:

Ckg1—5 to 12 inches, white (10YR8/1, dry), stony, silty clay loam till; weak fine pseudo-crumb; friable when moist, cemented when dry; moderately alkaline and very strongly calcareous; iron stained; grades through a gradual, wavy boundary into:

Ckg2—12 to 24 inches, white (5Y8/2, dry), stony, silty clay loam till; weak fine pseudo-crumb; firm when moist, cemented when dry, plastic and very sticky when wet; moderately alkaline and very strongly calcareous; weakly iron stained.

Mapping Units

Meleb series (182,364 acres)

Areas consisting dominantly of Meleb soils. Minor occluded areas are principally Chatfield, Inwood, Malonton till substrate phase, Balmoral till substrate phase and Fyala till substrate phase soils.

Inwood-Meleb complex (428,707 acres)—see Inwood series.

Agriculture;

Most of the total area of Meleb soils is still unbroken and is used extensively as native pasture land. Carrying capacity is low, par-

ticularly in areas covered by black poplar and aspen woods. The native grasses and sedges are low in phosphorus content and cattle grazing on this forage may require mineral supplements. Many areas of Meleb soils have been broken, particularly in the vicinity of main roads and villages. While these soil areas were more attractive for cultivation than the surrounding better drained land, because of greater ease of clearing and less stoniness, their high frequency of flooding and waterlogging has been a major problem. Improvement in surface drainage is difficult in most areas because of the ridges that lie across the direction of land fall. Also, these soils require an optimum level of moisture if they are to sustain plant growth. They should be used mainly for forage production as grain crops will not produce well in most years.

MORTON COMPLEX

The Morton complex consists of moderately well to well drained, Dark Grey Wooded and Orthic Grey Wooded soils developed on strongly calcareous, moderately coarse to moderately fine textured deltaic sediments. These soils were mapped as a complex of textural and profile types due to the textural stratification and the influence of this textural banding on the profile characteristics. Surface textures of the plow layer range from fine sandy loam to clay loam and the underlying material usually has layers of very fine sand to silty clay loam. These soils occur principally along the margins of the lacustrine plains and on terraces of the former glacial lake. They are underlain by strongly calcareous till. The topography is smooth, level to very gently sloping. Most areas are now cultivated, but the native vegetation appears to have been dominantly aspen and spruce with some bur oak and elm. Scattered small stones and an occasional boulder occur on the till substrate phase.

The Morton soils show variable degrees of degradation. The soils with a fine sandy surface layer have a better developed and thicker, leached Ae horizon than those with finer surface layers. A thin, very dark grey Ah horizon is present in some soils. The Bt horizon is well developed in all Morton soils and is clay loam to clay in texture. The solum seldom exceeds 12 inches in thickness and is underlain by very strongly calcareous material. A profile description of a minimal Orthic Grey Wooded Morton soil developed on stratified parent material is given in the upper right column.

L-H—1 to 0 inches, very dark brown (10YR2/2, dry), leaf mat partially decomposed; neutral; grades through a clear, smooth boundary into:

Ah —0 to 1 inch, very dark grey (10YR3/1, dry), fine sandy loam; weak fine granular; very friable when moist, soft when dry; neutral; grades through a clear, smooth boundary into:

Ae —1 to 3 inches, light greyish brown (10YR6/2, dry), fine sandy loam; weak fine platy; very friable when moist, soft when dry; slightly acid; grades through a clear, smooth boundary into:

BA —3 to 5 inches, greyish brown (10YR5/2, dry), fine sandy clay loam; moderate fine to medium blocky; firm when moist, hard when dry; slightly acid; grades through a clear, smooth boundary into:

Bt —5 to 8 inches, very dark greyish brown to dark greyish brown (10YR3/2 to 4/2, dry), clay; strong fine to medium subangular blocky; firm when moist, hard when dry; medium acid; grades through a clear, smooth boundary into:

BC —8 to 11 inches, greyish brown (10YR5/2, dry), clay loam; moderate fine crumb; friable when moist, slightly hard when dry; mildly alkaline and moderately calcareous; grades through a gradual, smooth boundary into:

Ck —11 to 30 inches, light grey (2.5Y7/2, dry), loam to silt loam; weak fine pseudo-crumb; friable when moist, soft when dry; moderately alkaline and strongly calcareous; iron stained in lower portion.

FIGURE 35

Soil profile of Morton fine sandy clay loam. An Orthic Grey Wooded soil developed on very calcareous deltaic sediments.

TABLE 22

Analysis of Morton Fine Sandy Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-1				7.2	0.74	2.2	10.73	1.64	6.6						
Ae	1-3	55.9	34.7	9.4	6.7	—	0.1	1.30	0.06	22.0	6.9	3.9	0.9	0.2	0.3	1.6
BA	3-5				6.8	—	0.2	0.81	0.08	10.3	22.1	14.1	5.6	0.1	0.7	2.7
Bt	5-8	32.7	18.4	48.9	5.9	—	1.3	1.31	0.09	14.4	36.1	20.5	10.3	0.1	1.0	2.2
BC	8-11				7.6	0.42	34.1	0.68	0.06	10.8	17.7	11.9	5.2	0.1	0.5	—
Ck1	11-19	28.9	48.3	22.8	7.6	0.36	50.8	0.47	0.04	13.1						
Ck2	19-25	22.3	51.8	25.9	7.9	0.34	52.2	0.29	0.02	12.1						
Ck3	25-30				8.0	0.35	52.5	0.11	0.00	—						

Mapping Units

Morton complex (4,720 acres)

Areas consisting dominantly of normal Morton soils. Minor occluded areas are principally Ledwyn, Pine Ridge and Morton till substrate phase soils.

Morton till substrate phase (6,257 acres)

Areas of Morton soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. In these soils the B horizon usually terminates at the base of the lacustrine mantle. A thin gravel or cobble lens is common between the two materials. The areas are usually recognized by the presence of scattered stones on the surface. The till substrate contains about the same percentage of calcium carbonate as the lacustrine sediments and has had little effect on profile development.

Agriculture:

The Morton soils are moderately fertile and have a more favorable reaction in the surface layers than the nondegraded soils developed on similar high-lime materials (Lakeland, Balmoral, Inwood, Lundar, etc.). They are suited to grain and forage production. However, the organic matter content is low and they will likely respond to nitrogen and phosphorus fertilization. Bare fields are very susceptible to wind erosion, which causes rapid reduction of productivity through removal of the surface material.

NARCISSE SERIES

The Narcisse series consists of well-drained, Orthic Black soils developed on a thin mantle of strongly calcareous stratified drift and glacial till over limestone bedrock. Surface textures vary from sandy loam to clay loam. These soils occur in scattered areas throughout the central and northern portion of the Interlake Till Plain, with the largest acreage in the country north of Inwood and in the area north of Eriksdale. They occur mainly in complex areas with Stonewall, Inwood or Garson soils occupying the portion of the areas with thicker till deposits over the bedrock. These areas are dominantly smooth and level and are conspicuous as patches of grassland in the forested

FIGURE 36

Soil profile of Narcisse clay loam. An Orthic Black soil developed on a thin mantle of glacial drift over limestone bedrock. Note glacial striae on bedrock surface.

region. Dryland grasses and herbs, such as spear grass and Potentilla, are the dominant native vegetation on the Narcisse soils. The thin surface deposit restricts water-holding capacity and the underlying bedrock retards tree growth so that these are locally arid, grassland soils in a sub-humid, forested region. All areas are exceedingly stony.

The Narcisse soils consist of a thin, very dark grey A horizon, underlain by an equally thin, dark greyish brown B horizon. The solum is usually less than 8 inches thick and may be only 3 or 4 inches in areas of very shallow drift deposits. The limestone bedrock occurs between 6 and 30 inches from the surface. A representative profile of Narcisse clay loam is described below:

Ah —0 to 3 inches, very dark grey (10YR3/1, dry), clay loam; moderate medium granular; friable when moist, slightly hard when dry; neutral; grades through a gradual, smooth boundary into:

Bm —3 to 5 inches, dark greyish brown (10YR4/2, dry), clay loam; moderate medium granular; friable when moist, slightly hard when dry; neutral; grades through a gradual, smooth boundary into:

Ck —5 to 18 inches, very pale brown (10YR7/3, dry), stony, clay loam till; weak fine pseudo-crumb; friable when moist, strongly cemented when dry; moderately alkaline and strongly calcareous; rests directly on:

IICr—18+ inches, limestone bedrock.

Mapping Units

Narcisse series (3,430 acres)

Areas consisting dominantly of Narcisse soils. Minor occluded areas are principally Garson, Stonewall and Inwood soils and limestone Rock Outcrop.

Garson-Narcisse complex (8,101 acres)—see Garson series.

Stonewall-Narcisse complex (60,782 acres)—see Stonewall series.

Inwood-Narcisse complex (11,123 acres)—see Inwood series.

Agriculture:

The Narcisse soils are of very low agricultural value. They are suited only for use as native pasture land but have a low carrying capacity. The extreme stoniness of most areas precludes seeding of better grasses, and the droughtiness of these thin, highly calcareous soils restricts growth of the native plants.

OSBORNE SERIES

The Osborne series consists of poorly drained, Orthic Meadow and saline Orthic Meadow soils developed on weakly to moderately calcareous lacustrine clay. These soils occupy a very large acreage in the Red River Plain to the south of the Teulon map area (see Winnipeg-Morris Soil Report No. 5). However, in the Fisher-Teulon map areas the poorly drained soils developed on lacustrine clay are dominantly Peaty Meadow soils and belong to the Fyala series. Osborne soils occur only along the eastern edge of the northern projection of the Red River Plain. The topography is smooth, level to depressional. Runoff is slow and the soils have low permeability, so that the soils are wet for a prolonged period in the spring and are slow to dry after heavy summer rains. The native vegetation consists of meadow grasses, sedges and associated herbs, with patches of salt-tolerant species in saline areas. Scattered surface stones occur only on the areas of till substrate phase soils.

The Osborne soils have less than 3 inches of organic material on the surface, underlain by a thin very dark grey A horizon of 3 to 6 inches in thickness. The A horizon tongues into the olive grey, gleyed C horizon which is weakly to moderately calcareous and may contain gypsum crystals and salt pseudo-mycelium. A repre-

TABLE 23

Analysis of Narcisse Clay Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah	0-3	41.2	29.7	29.1	7.1	0.27	0.6	5.88	0.53	11.1	39.9	27.2	12.0	0.2	0.5	—
Bm	3-5	46.1	25.6	28.3	7.0	0.24	0.1	2.37	0.24	9.9	34.1	25.0	9.3	0.1	0.4	—
Ck	5-18	28.7	41.4	29.9	7.8	0.26	40.7	0.79	0.09	8.8						

sentative, virgin profile of Osborne clay is described below:

F-H—2 to 0 inches, black (10YR2/1, dry), muck; mildly alkaline; grades through a clear, smooth boundary into:

Ah —0 to 4 inches, very dark grey (10YR3/1, dry), clay; weak fine to medium granular; very plastic and very sticky when wet, very hard when dry; mildly alkaline; tongues through a clear, irregular boundary into:

Cg —4 to 24 inches, olive grey (5Y5/2, dry), clay; massive; very plastic and very sticky when wet, very hard when dry; moderately alkaline and contains calcium carbonate concretions; iron stained.

Mapping Units

Osborne series (7,377 acres)

Areas consisting dominantly of normal Osborne soils. These areas are level and quite uniform. The minor occluded areas that do occur are principally Fyala, Osborne till substrate phase and Red River soils.

Osborne till substrate phase (558 acres)

Areas of Osborne soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. These areas are recognizable by the presence of scattered small stones on the surface. The till substrate has not affected soil development in these poorly drained areas.

Agriculture:

Surface drainage has been improved in most areas of Osborne soils in the Teulon map area. The installation of drainage ditches has improved the agricultural value of these soils for grain and forage production. However, they are still subject to local flooding and waterlogging during wet seasons and have many tillage problems. They are not suited to the production of root crops and barley does poorly in most years. These wet, heavy clay soils are slow to warm-up in the spring and crops respond very favorably to nitrogen and phosphorus fertilization.

PEGUIS SERIES

The Peguis series consists of imperfectly drained, Gleyed Dark Grey soils developed on weakly to moderately calcareous lacustrine clay. The Peguis soils occur extensively in the Winnipeg Lake Terrace area and in the outer portion of the Icelandic River Lowland. They also occupy small, scattered areas in the Fisher River Plain. The topography is smooth to irregular level. Runoff and internal drainage are slow. Vegetative cover of the virgin soils is mainly aspen; some white spruce and birch occur in the more northerly areas. The normal Peguis soils are stone-free and the scattered stones that occur on areas of the till substrate phase do not hinder cultivation.

The Peguis soils are slightly degraded under woods, as evidenced by blotching in the A horizon and the presence of a dark greyish brown, blocky structured B horizon with clay skins around the aggregates. The virgin soils are slightly acid in the A horizon and neutral to mildly alkaline in the B horizon. The lower part of the B horizon is slightly calcareous. Tongues of the dark grey A horizon commonly extend down through the B horizon and into the parent material. A representative profile of Peguis clay is described below:

L-H —2 to 0 inches, dark reddish brown (5YR2/2, dry), leaf mat consisting of partially decomposed aspen and shrub leaves; neutral; grades through a clear, smooth boundary into:

Ahej—0 to 5 inches with tongues to 10 inches, very dark grey and dark grey (10YR3/1 and 4/1, dry), clay; strong fine blocky; very firm when moist, very hard when dry; slightly acid; grades through a gradual, irregular boundary into:

Btg —5 to 10 inches, dark greyish brown (2.5Y4/2, dry), clay; strong fine subangular blocky; very firm when moist, very hard when dry; mildly alkaline, slightly calcareous in lower portion; iron stained; grades through a gradual, irregular boundary into:

Ckg —10 to 36 inches, light brownish grey (2.5Y6/2, dry), clay; weak medium pseudo-granular; firm when moist, hard when dry, plastic and sticky when wet; moderately alkaline and calcareous; contains calcium carbonate concretions and iron mottles.

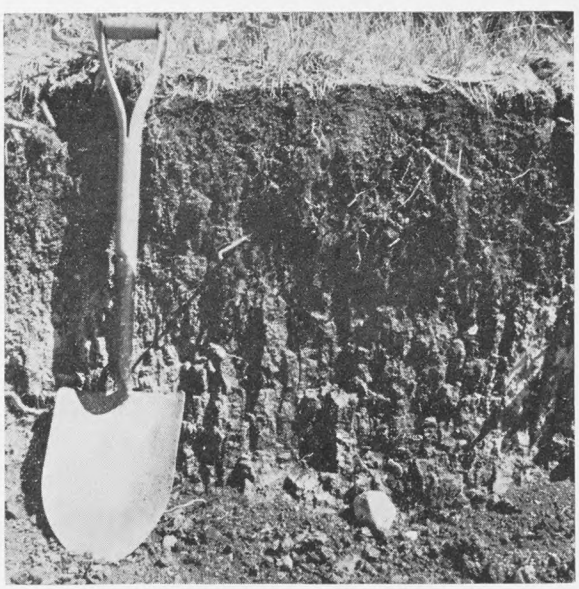


FIGURE 37

Soil profile of Peguis clay. A Gleyed Dark Grey soil developed on lacustrine clay.

TABLE 24

Analysis of Peguis Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	2-0				6.7	0.40	0.9	29.83	1.78	16.8						
Ahej	0-5	17.7	15.8	66.6	6.3	—	—	1.37	0.17	8.1	44.4	20.2	17.4	0.2	1.5	2.9
Btg	5-10	8.5	16.5	75.1	7.6	0.31	7.2	0.55	0.11	—	39.7	19.8	18.5	0.2	1.2	—
Ckg	10-36	2.7	17.3	80.0	8.1	0.28	14.2	0.13	0.03	—						

Mapping Units

Peguis series (30,070 acres)

Areas consisting dominantly of normal Peguis soils. Minor occluded areas are principally Peguis till substrate phase, Arnes and Fyala soils.

Peguis till substrate phase (48,294 acres)

Areas of Peguis soils in which a substrate of till or water-worked till occurs within 30 inches of the surface. The till substrate is commonly clay in texture or has layers of clay interbedded with more calcareous, clay loam till. The till substrate appears to have had no appreciable effect on the soil profile development. Scattered small stones occur on the surface of most areas.

Agriculture:

The Peguis soils represent the largest acreage of good agricultural land of any one series in the map areas. They are well suited to grain and forage crop production. They are naturally fertile and have a favorable, neutral to slightly acid reaction. Although they are heavy clay soils, the structure is such that they can be maintained in a reasonably good state of tilth if the organic matter content is maintained. Local flooding or water-logging is a hazard in seasons of above average rainfall.

PINE RIDGE SERIES

The Pine Ridge series consists of well-drained, Orthic Grey Wooded soils developed on moderately calcareous, sandy deltaic and beach deposits. Surface textures are loamy fine sand to sand. These soils occur in proximity to Leary soils at the margins of the lacustrine plains. The topography is smooth, level to very gently sloping. The native vegetation is dominantly aspen with some white spruce. Scattered small stones occur on the surface of the till substrate phase.

The Pine Ridge soils are developed on sandy material with a low clay content and the textural B horizon is weak in comparison to Grey Wooded soils developed on finer materials. Conversely, the leached Ae horizon is comparatively thick, often extending to 10 or more inches below the surface. The solum is slightly to medium acid in reaction and the C horizon is moderately alkaline and calcareous. A representative profile of Pine Ridge fine sand is described below:

L-H—1 to 0 inches, very dark brown (10YR2/2, dry), leaf mat consisting of partially decomposed aspen leaves; neutral; grades through a clear, smooth boundary into:

Ae —0 to 7 inches, pale brown (10YR6/3, dry), fine sand; structureless; loose; slightly acid; grades through a gradual, smooth boundary into:

AB —7 to 10 inches, brown (10YR5/3, dry), fine sand; weak fine crumb; very friable when moist, soft when dry; slightly acid; grades through a gradual, smooth boundary into:

Bt —10 to 13 inches, brown (7.5YR5/4, dry), fine sandy loam; weak fine blocky; friable when moist, slightly hard when dry; neutral; grades through an abrupt, smooth boundary into:

Ck —13 to 36 inches, very pale brown (10YR7/3, dry), stratified fine sand and sand; structureless; loose; moderately alkaline and calcareous.

Mapping Units

Pine Ridge series (4,553 acres)

Areas consisting dominantly of normal Pine Ridge soils. Small occluded areas are mostly Pine Ridge till substrate phase, Morton and Leary soils.

Pine Ridge till substrate phase (930 acres)

Areas of Pine Ridge soils in which a substrate of strongly calcareous till occurs within 30 inches of the surface. A gravel or cobble lens commonly occurs between the sandy mantle and the underlying till, and the B horizon is developed partially in this coarser lens. The till substrate impedes internal percolation and these soils are usually more moist than the normal Pine Ridge soils. Scattered small stones occur on the surface of most areas.

Agriculture:

The Pine Ridge soils are leached, sandy soils which are low in organic matter, available plant nutrients and water-holding capacity. They are very susceptible to wind erosion if the surface is exposed. They are more suited to hay crops than for grain production. If utilized for grain production they should be protected from wind erosion at all times and methods of adding organic matter to the soil should be employed.

PLUM RIDGE SERIES

The Plum Ridge series consists of imperfectly drained, Gleyed Rego Black soils developed on medium to moderately coarse textured deltaic deposits. Surface textures range from fine sandy loam to silt loam and the deposits on which the soils have developed are often stratified, commonly becoming coarser with depth. These soils occur along the north western margin of the Red River Plain, with the largest area in the vicinity of Pleasant Home and smaller areas in the Balmoral district and on the small deltaic fan west of Gimli. The topography is smooth to irregularly level. Runoff is slow and internal drainage is impeded by a finer textured substrate upon which occurs a fluctuating water table. The native vegetation is meadow-prairie grasses and herbs with scattered groves of aspen, black poplar and willow. The normal Plum Ridge soils are stone-free, but scattered small stones occur on areas of the till substrate phase.

The Plum Ridge soils consist of a moderately thick, very dark grey A horizon that grades gradually through a brownish grey transitional layer into light grey to pale yellow, strongly calcareous parent material. These soils are usually alkaline and slightly calcareous in the A horizon and are iron stained in the AC and C horizons. A representative profile description of Plum Ridge very fine sandy loam is given below:

Ah1—0 to 5 inches, very dark grey (10YR3/1, dry), very fine sandy loam; weak fine granular; very friable when moist, soft when dry; weakly alkaline and calcareous; grades through a gradual, wavy boundary into:

Ah2—5 to 10 inches, dark grey (10YR4/1, dry), very fine sandy clay loam; weak fine granular; very friable when moist, soft when dry; moderately alkaline and strongly calcareous; grades through a gradual, wavy boundary into:

AC —10 to 16 inches, dark greyish brown (10YR4/2, dry), loam; weak fine granular; very friable when moist, soft when dry; moderately alkaline and strongly calcareous; iron stained; grades through a clear, irregular boundary into:

Ckg—16 to 22 inches, light grey (10YR7/2, dry), very fine sandy loam; weak fine pseudo-granular; very friable when moist, weakly cemented when dry; moderately alkaline and very strongly calcareous; iron stained; grades through a diffuse, irregular boundary into:

Cg —22 to 36 inches, pale yellow (2.5Y7/4, dry), very fine sandy loam; weak fine pseudo-granular; very friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

TABLE 25

Analysis of Plum Ridge Very Fine Sandy Loam

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
Ah1	0-5	55.9	25.2	18.9	7.3	0.90	6.6	13.34	0.88	15.1	46.1	33.6	10.8	0.3	1.4	—
Ah2	5-10	50.3	24.7	25.0	8.1	0.58	32.9	2.72	0.21	13.2	14.1	9.5	4.1	0.2	0.3	—
AC	10-16	42.2	35.2	22.5	8.2	0.43	51.7	1.19	0.09	13.1						
Ckg1	16-22				8.3	0.46	55.7	0.48	0.08	—						
Ckg2	22-28	57.8	35.8	6.4	8.3	0.42	45.3	0.36	0.00	—						
Cg	28-36				8.2	0.41	39.2	0.01	0.02	—						

Mapping Units

Plum Ridge series (11,378 acres)

Areas consisting dominantly of normal Plum Ridge soils. Minor occluded areas are principally Plum Ridge till substrate phase, Foley, Lakeland, and Balmoral soils.

Plum Ridge till substrate phase (423 acres)

There are two small areas of Plum Ridge soils in the Teulon map area in which a substrate of strongly calcareous glacial till occurs within 30 inches of the surface. These areas have irregular, level topography. Scattered small stones occur on the surface of the soil.

Agriculture:

The Plum Ridge soils are moderately high in natural fertility, but contain a deleterious amount of lime carbonate, particularly in the lower portion of the A and in the C horizon. These soils are very susceptible to wind erosion and loss of the upper portion of the A horizon will seriously reduce fertility. Excessive moisture may delay seeding or damage growing crops in wet seasons. Nitrogen and phosphorus fertilizers are required for maximum yields of grains and forage crops.

POLSON COMPLEX

Areas mapped as Polson complex contain a variety of poorly and imperfectly drained soils developed on coarse sand and gravel deposits which commonly are overlain by a very thin mantle of moderately coarse to fine textured sediments. Peaty Meadow and Gleyed Rego Black soils constitute most of the acreage of Polson complex, although Orthic Meadow, Degraded Meadow and Gleyed Dark Grey soils also occur in some areas. These soils occupy level to depressional areas bordering gravelly beach ridges and some narrow runways in the Interlake Till Plain. The gravel and sand deposits are thin and are underlain by strongly calcareous till. This till substrate occurs within 30 inches of the surface in most areas. Runoff is slowed or entirely prevented by the bordering higher land and internal drainage is impeded by the finer textured substrate. These drainage restrictions cause a high water table to be present in all but very dry seasons. The native vegetation is dominantly meadow grasses; sedges and reeds occur in locally wet areas and clumps of willow and black poplar on the imperfectly drained sites. Most areas are cobbly on the surface and contain scattered boulders.

While the Polson complex contains a number of soil profile types, the variations are minor and of little significance to the agricultural use of the areas. The Peaty Meadow soils are most common and have a thin layer of fen peat that is alkaline in reaction and usually calcareous. The mineral soil consists of a thin, gleyed and calcareous A horizon developed in the finer textured mantle and underlain by very calcareous and strongly iron stained sand and gravel. The Gleyed Rego Black soils lack the peat layer and have a greyish brown, transitional AC layer between the very dark grey A horizon and the gleyed, light grey C horizon. The degraded soils are blotched with lighter colored areas in the A horizon and have a very weakly developed dark greyish brown textural B horizon. While these soils are slightly leached, they are commonly alkaline and calcareous to the surface due to the influence of fluctuating, lime charged ground water.

Mapping Units

Polson complex (781 acres)

A few small areas of Polson soils in which the gravel and sand deposits are more than 30 inches thick. A till substrate occurs at varying depths below this level.

Polson till substrate phase (5,626 acres)

The more common areas of Polson soils in which the till substrate is dominantly within 30 inches of the surface.

Agriculture:

The Polson soils are not suited to the production of cultivated crops due to poor drainage and low fertility. They occur in small scattered areas adjacent to gravel ridges or in narrow runways and provide limited native pasturage during drier seasons.

RED RIVER SERIES

The Red River series consists of imperfectly drained, Gleyed Rego Black soils developed on weakly to moderately calcareous lacustrine clay. These soils occur in only a few small areas in the south-east corner of the Teulon map area, but they occupy a very extensive acreage in the Red River Plain to the south (see Soil Survey Report No. 5 covering the Winnipeg and Morris map areas). The topography is smooth and level. Drainage is imperfect due to slow runoff and slow internal percolation. The native vegetation was meadow-prairie grasses and herbs with scattered aspen groves toward the edge of the soil areas. The soils are free of surface stones.

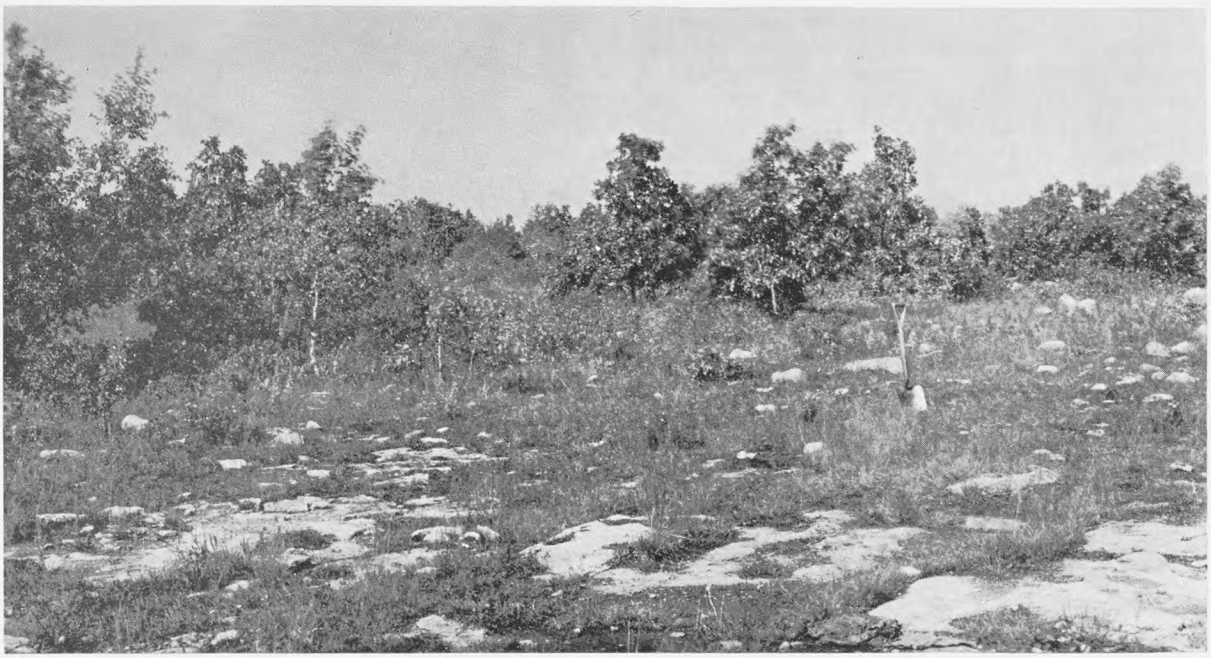


FIGURE 38

Outcrop of limestone bedrock with stunted trees growing on thin drift deposits over the rock in the background.

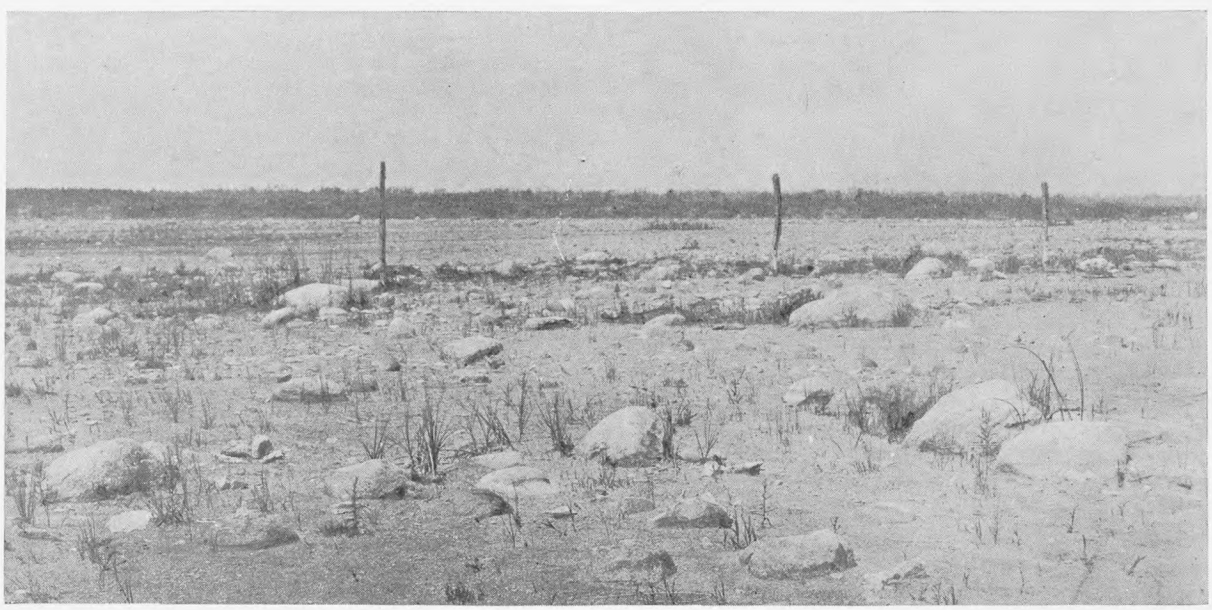


FIGURE 39

Saline flats bordering Dog Lake. This area is periodically under water when the lake is high.

The Red River soils in the Teulon map area are very weakly solonetzic, as evidenced by a weak prismatic macro-structure in the A horizon that breaks readily into coarse granular aggregates. This very dark grey, heavy clay textured A horizon grades through a thin, transitional AC layer into iron stained, greyish brown clay parent material. A representative profile of Red River clay is described below:

Ah—0 to 8 inches, very dark grey (10YR3/1, dry), clay; weak coarse prismatic macro-structures break to strong coarse granular aggregates; plastic and sticky when wet, hard when dry; mildly alkaline; grades through a gradual, irregular boundary into:

Cg—8 to 36 inches, greyish brown (2.5Y5/2, dry), clay; massive; very plastic and very sticky when wet, very hard when dry; moderately alkaline and moderately calcareous; iron stained.

Mapping Units

Red River series (924 acres)

Areas consisting dominantly of Red River soils. Minor occluded areas are principally Osborne and Peguis soils.

Agriculture:

The soils of the Red River series are good agricultural soils with minor problems of drainage and tilth. They are high in fertility, organic matter content and moisture holding capacity. However, they are subject to waterlogging or local flooding during very wet seasons and are difficult to till when very wet or very dry. Their fine texture and imperfect drainage limits their value for root crops.

ROCK (12,141 acres)

Areas in which there is less than 6 inches of surface deposits over consolidated limestones and dolostones were mapped as Rock. These areas occur mainly in the high land separating the Icelandic and Fisher river plains and in the area north of Inwood where the surface deposits are generally very thin. The areas have only a sparse growth of xerophytic grasses and herbs, and occasional stunted jack pine on the portions of the areas with a few inches of soil material over the rock. The rocks are flat-bedded dolomitic limestones of Palaeozoic age. Glacial striae or grooves are common on exposed surfaces and are helpful in tracing the direction of ice movement during the last glacial period.

Agriculture:

Areas of rock outcrop are of very low agricultural value and are used only in conjunction with surrouding areas as very poor native pasture land. Some areas afford ready access for quarrying the limestone rock for building and industrial uses.

SALINE FLATS

Areas mapped as Saline Flats, bordering Lake Manitoba, Sleeve Lake and the Shoal lakes, are largely bare of vegetation and have a white encrustation of salts on the surface. These areas are periodically covered by the lakes during high water stages and no discernible soil horizons have developed on the very strongly saline material. These soils are classified as Saline Regosols. The soil material consists of moderately to very stony water-worked till, and is strongly gleyed, bluish-grey in color and strongly iron stained.

Mapping Units

Saline Flats (1,459 acres)

An area surrounding Sleeve Lake that consists dominantly of bare, salt encrusted flats. The extent of this area will vary with the water level of the lake.

Marsh-Saline Flats complex (22,207 acres)—see Marsh complex.

Agriculture:

The areas of Saline Flats have no agricultural value. Areas of Marsh-Saline Flats complex have a low value as native hay and pasture land. The forage is of very low quality and the areas are often inaccessible during the haying season.

SAND BEACHES (2,126 acres)

Sand beaches and low sandy beach ridges are presently being formed along the shores of Lake Winnipeg and Lake Manitoba. At some places along the lake shores these fresh sandy deposits occupy areas of mappable size. While these areas have no agricultural value, they provide excellent recreational sites and many summer resorts have been developed in their vicinity. Along the shore of Lake Winnipeg, from Matlock to Gimli, summer resorts occupy an almost continuous strip of land and represent an important land use in the area.

SHALLOW PEAT DRAINED PHASE (17,971 acres)

Areas of shallow peat soils in which the drainage has been improved through the installation of ditches were mapped as Shallow Peat drained phase. These are soils with 12 to 36 inches of peat over undifferentiated mineral material. The organic layer is mainly fen

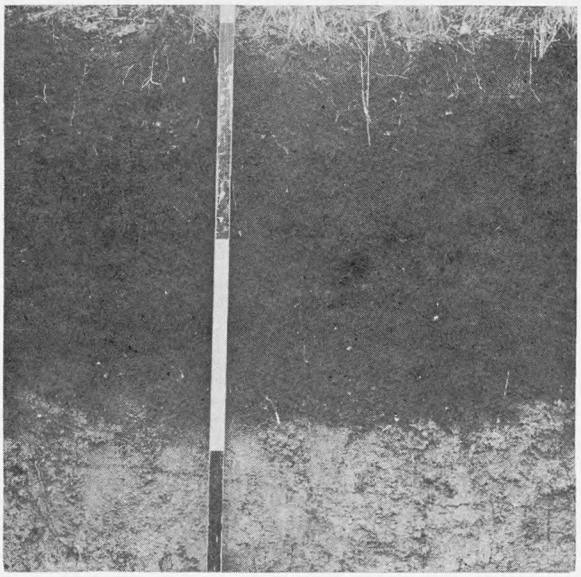


FIGURE 40

Soil profile of Shallow Peat. An organic soil with 12 to 36 inches of peat over the mineral soil. (Stick Interval = 12 inches)

peat that is neutral to alkaline in reaction and may be calcareous due to the presence of lime-charged ground water. These soils occur in scattered locations within the Icelandic River Lowland. The mineral material underlying the peat is mostly clay that has been strongly gleyed and is strongly mottled with iron. There is little or no soil horizon development in the clay.

Agriculture:

Some areas of these drained, peaty soils are cultivated and used for grain and hay production. Yields are generally low. The peat layer is low in available plant nutrients and crops will usually respond to a complete fertilizer (one containing nitrogen, phosphorus and potash). Production on these soils also suffers from extremes in moisture conditions. In the spring, the soils are usually saturated with water and seeding is late. Later in the year, particularly in seasons of low rainfall, the peaty soil may become very dry and the crops wilt and ripen prematurely. Cultivated fields are susceptible to loss of the finer organic particles through wind erosion and this reduces the fertility level. These soils are more suited to forage crops than for grain production, at least until the peat layer is decomposed and is mixed with the underlying mineral material. Destruction of the peat layer by burning is not recommended as the underlying clay is low in organic matter, low in available plant nutrients and has very poor tilth.

SHORNCLIFFE SERIES

The Shorncliffe series consists of imperfectly drained, Gleyed Dark Grey Wooded soils developed on a thin mantle of lacustrine clay overlying strongly calcareous silty deltaic deposits. The surface texture is uniformly clay. These soils occur near the margins of the Icelandic and Fisher river plains, principally in the Shorncliffe and Fisherton districts. The topography is level and drainage is imperfect due to slow runoff and low permeability of the clay surface layer. The native vegetation is dominantly aspen with some spruce and an undergrowth of willow, hazel, rose and herbaceous plants. The soils are stone-free.

The solum of the Shorncliffe soil is developed in the clay surface layer and varies in thickness with variations in depth of this layer. The leached Aeh horizon is quite prominent when the soil is dry but is difficult to discern when the soil is moist or wet. The textural B horizon has a well developed blocky structure and dark greyish brown color. The soils are periodically saturated with lime-charged ground water and are mostly neutral to mildly alkaline in the A and B horizons. The substrate of strongly calcareous silty sediments is commonly stratified but silty clay and silty clay loam textures predominate. The description of a representative, virgin Shorncliffe clay profile is given below:

L-H —1 to 0 inches, very dark brown (10YR2/2, dry), leaf mat consisting mainly of partially decomposed aspen leaves; neutral; grades through a clear, smooth boundary into:

Aehg —0 to 3 inches, greyish brown (10YR5/2, dry), clay; moderate fine blocky; firm when moist, hard when dry; neutral; weakly iron stained; grades through a gradual, smooth boundary into:

Btg —3 to 9 inches, dark greyish brown (10YR4/2, dry), clay; strong fine blocky; very firm when moist, very hard when dry; neutral; iron stained; grades through a clear, smooth boundary into:

BC —9 to 12 inches, light brownish grey (2.5Y6/2, dry), clay; moderate medium granular; firm when moist, hard when dry; mildly alkaline and moderately calcareous; iron stained; grades through a clear, smooth boundary into:

IICkg—12 to 36 inches, light grey to white (2.5Y7/2 to 8/2, dry), silty clay; weak fine pseudo-granular; friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

TABLE 26

Analysis of Shorncliffe Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	1-0				7.0	0.42	2.1	15.87	0.96	16.5						
Aehg	0-3	18.9	33.3	47.8	6.6	0.29	0.0	2.80	0.22	12.7	36.1	15.9	15.8	0.1	0.8	—
Btg	3-9	8.5	22.4	69.1	6.8	0.20	0.2	1.32	0.12	11.0	42.2	14.8	24.3	0.2	1.2	—
BC	9-12	2.6	36.7	60.7	7.7	0.30	21.8	—	—	—	32.7					
IICkg	12-36	2.2	40.9	56.9	8.2	0.37	38.9	—	—	—						

Mapping Units

Shorncliffe series (4,543 acres)

Areas consisting dominantly of Shorncliffe soils. Minor occluded areas are principally Peguis, Tarno and Fyala soils.

Agriculture:

The Shorncliffe soils are moderately productive, with minor problems of imperfect drainage, excessive liminess of the substrate and moderately low organic matter content. These soils require fertilization with nitrogen and phosphorus for maximum production of grain and forage crops.

STONEWALL COMPLEX

The Stonewall complex consists of well-drained and moderately well drained, Dark Grey Wooded and Dark Grey soils developed on strongly calcareous till. Surface textures vary widely from sandy loam to clay due to the inclusion in the complex of soils with a thin mantle of lacustrine sediments (up to six inches) over the loam to clay loam till. These soils occupy much of the well-drained land in the Interlake Till Plain. They occur commonly with Narcisse soils in areas where the limestone bedrock is close to the surface. The topography is irregular, level to gently sloping. The native vegetation is dominantly aspen with a minor occurrence of bur oak and white spruce. The Stonewall soils are very stony and except in a few areas with a lacustrine mantle the stones are a serious handicap to cultivation.

The solum of the Stonewall soils is generally less than 10 inches thick. Dark Grey and Dark Grey Wooded soils occur in close association

FIGURE 41

Road cut through an area of Shorncliffe soils showing variable depth of Ae horizon.

FIGURE 42

Piled stones picked from field of Stonewall soils.

and could not be separated on the scale of mapping used. All Stonewall soils have a thin, distinct textural B horizon but they vary in the degree of eluviation of the A horizon. The more strongly degraded soils have a thin, very dark grey Ah horizon underlain by a weakly developed, dark greyish brown Aej horizon. In soils with a lesser degree of leaching the Ae horizon is absent but the Ah horizon may be blotched with lighter colored patches. Virgin Stonewall soils are neutral to slightly acid in the A and B horizons but in the plow layer of cultivated soils the reaction is usually alkaline due to a mixing of the solum with the strongly calcareous substrate. A representative virgin profile of a Dark Grey Wooded Stonewall soil is described below:

L-H—1 to 0 inches, very dark brown (10YR2/2, dry), aspen leaf mat; neutral; grades through a clear, smooth boundary into:

Ah —0 to 1 inch, very dark grey (10YR3/1, dry), loam; weak fine granular; very friable when moist, soft when dry; neutral; grades through a clear, irregular boundary into:

Aej —1 to 3 inches, dark greyish brown (10YR4/2, dry), loam; moderate medium to coarse platy; firm when moist, hard when dry; slightly acid; grades through a clear, smooth boundary into:

Bt —3 to 7 inches, very dark brown (10YR2/2, dry), clay loam; strong fine subangular blocky; very firm when moist, very hard when dry; neutral; grades through a clear, smooth boundary into:

BC —7 to 10 inches, greyish brown (10YR5/2, dry), stony loam till; moderate medium granular; friable when moist, slightly hard when dry; mildly alkaline and moderately calcareous; grades through a gradual, smooth boundary into:

Ck —10 to 36 inches, light grey (10YR7/2, dry), stony loam till; weak medium pseudo-granular; friable when moist, cemented when dry; moderately alkaline and strongly calcareous.

Mapping Units

Stonewall complex (89,259 acres)

Areas consisting dominantly of normal Stonewall soils. Minor occluded areas are mainly Garson and Inwood soils.

Stonewall rock substrate phase (4,495 acres)

Areas of Stonewall soils in which limestone bedrock occurs within 30 inches of the surface. These areas are excessively stony.

Stonewall-Narcisse complex (60,783 acres)

Areas in which the limestone bedrock is close to the surface and Stonewall and Narcisse soils occur in close association. Within this complex the Narcisse soils, having bedrock within 30 inches, occur under grass and herbaceous vegetation and the Stonewall soils with thicker deposits occur under trees.

Stonewall-Berlo complex (797 acres)

A few small areas in the vicinity of Berlo where narrow till ridges with Stonewall soils are separated by areas of Berlo soils developed on sand deposits in the intervening swales. The sandy deposits in the former swales have levelled these areas so that the present land surface is quite smooth. The Stonewall soils are easily discernible in cultivated fields as narrow ribbons of stony land.

Agriculture:

The Stonewall soils are generally not suited for cultivation due to excessive stoniness. Some small areas have been cleared and broken but intensive stone removal has been necessary. Most areas are used as pasture land, but the carrying capacity is very low. The value of these areas as pasture land could be improved through removal of the scrub aspen bush and possibly seeding of better grass species. The soils are moderately low in organic matter content and require nitrogen and phosphorus fertilizers for maximum forage production.

TARNO SERIES

The Tarno series consists of poorly drained, Peaty Meadow soils developed on a thin mantle of lacustrine clay over strongly calcareous silty deltaic deposits. These soils occur in the

TABLE 27

Analysis of Tarno Clay

Hor.	Depth inch.	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ equiv.	% Org. C	% Total N	C/N	Exch. cap. m.e.	Exchangeable Cations m.e./100 g.				
												Ca	Mg	Na	K	H
L-H	7-0				7.2	0.34	1.1	41.53	3.27	12.7						
Ah	0-4	3.6	37.4	59.0	7.5	0.83	22.4	3.29	0.41	8.0	39.4	17.2	20.7	0.5	1.0	—
AC	4-9	4.6	50.3	45.1	8.0	1.23	54.8	0.64	0.07	9.1	15.6	6.0	8.8	0.4	0.4	—
IICkg	9-14	2.6	59.9	37.5	8.0	1.38	62.3	0.37	0.05	7.4						
IICg	14-24	1.7	50.6	47.7	7.9	1.19	42.1	0.15	0.05	—						

lacustrine plains usually adjoining areas of Balmoral and Fyala soils. The topography is depressional to level and the soils are poorly drained due to very slow runoff and slow percolation. The native vegetation is dominantly meadow grasses, sedges and herbs with some clumps of willow and black poplar. The soils are stone-free.

The virgin Tarno soils have a thin surface covering of fen peat, but in many cultivated areas this peat layer has disappeared through burning or shrinkage and incorporation with the mineral soil. The A horizon is thin but varies with the thickness of the clay layer over the strongly calcareous silty substrate. Weak concentrations of soluble salts are common in these soils and some local areas are strongly saline. A representative virgin profile of Tarno clay is described below:

L-H —7 to 0 inches, dark reddish brown (5YR3/2, dry), fen peat; neutral; grades through an abrupt, smooth boundary into:

Ah —0 to 4 inches, very dark grey (10YR3/1, dry), clay; moderate medium granular; plastic and sticky when wet, firm when moist; mildly alkaline and moderately calcareous; grades through a gradual, smooth boundary into:

AC —4 to 9 inches, grey (5Y5/1, dry), silty clay; weak fine granular; plastic and sticky when wet, firm when moist; moderately alkaline and strongly calcareous; iron stained; grades through a clear, irregular boundary into

IICkg—9 to 14 inches, white (5Y8/2, dry), silty clay loam; weak medium pseudo-crumb; plastic and very sticky when wet, friable when moist; moderately alkaline and strongly calcareous; iron stained; grades through a gradual, irregular boundary into:

IICg —14 to 24 inches, light grey (2.5Y7/2, dry) silty clay; weak medium pseudo-crumb; plastic and very sticky when wet, friable when moist; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Tarno series (46,431 acres)

Areas consisting dominantly of Tarno soils. Minor occluded areas are principally Balmoral and Fyala soils.

Agriculture:

For cropping purposes the Tarno soils require artificial drainage. In most areas the drainage has been improved through the installation of open ditches. The thin peat layer, present on virgin soils, has been largely destroyed or mixed with the mineral soil in the plow layer, although some cultivated fields still have a peaty surface layer. Most areas of Tarno soils are still subject to water-logging or local flooding during wet seasons and delayed seeding or crop losses through excessive moisture are common. The very high lime content of the silty substrate adversely affects fertility, particularly in areas where the surface clay mantle is very thin. Organic matter content is moderately low. Fertilizers containing nitrogen and phosphorus are expected to increase yields of cereal and forage crops.

PART IV

AGRICULTURE

Agricultural interpretations of soil survey information are based on the extensive field observations of the soils and soil-plant relationships, and on the results of chemical and physical analyses conducted on representative soil samples. These interpretations are concerned with soil management problems, suitability of soils for different crops and productivity of the soils under various conditions.

A. ESTIMATED SUITABILITY OF SOILS FOR VARIOUS PURPOSES

The estimated suitability of the soils in the Fisher and Teulon map areas for various purposes is shown in Table 28. The estimates in this table are based on general observations and on a study of the characteristics expressed in the respective soil profiles. It should be observed that the respective average estimates must be modified on some farms to conform with local variations. Further, the estimates given are not absolute values based on crop yield data, but they represent the considered opinion and field observations of the soil surveyors.

B. AGRONOMIC SOIL GROUPS IN THE FISHER AND TEULON MAP AREAS

The soils of the Fisher and Teulon map areas have been divided into various agronomic soil groups* on the basis of general soil features that affect the field of agricultural practices. Some of these groups have been further divided into sub-groups to obtain classes of soils with similar management problems and productivity.

Agronomic group 1

This group consists of clay textured soils with imperfect to good drainage. It is divided into two sub-groups on the basis of soil tilth.

Sub-group 1A

Clay soils with good to fair tilth.

Arnes series	Red River series
Framnes series	Shorncliffe series
Peguis series	

These are good agricultural soils with some management problems. They have a high natural fertility and a high water holding capacity. They tend to become hard when dry, especially if the organic matter content is low. They are subject to water-logging in very wet seasons and some crop losses result from this cause. They are suited to the production of both grain and forage crops, but continuous grain cropping lowers the organic matter content and reduces soil fertility. Deep rooted legume crops are beneficial in improving internal drainage and will help to maintain the organic matter content and good tilth. These soils are not well-suited to root crops due to their clay texture and their tendency to excessive wetness.

Sub-group 1B—Clay soils with poor tilth.

Arborg series

These soils are moderately productive under favorable conditions but have major management problems arising from their heavy clay texture, poor structure and slow drainage. Tillage is difficult and is usually restricted to periods when soils have an optimum moisture content. Weeds are a severe problem. Organic matter content and nitrogen supply are low, and addition of fibrous materials is necessary to improve soil tilth. Grasses and legumes should be grown in rotation with grain crops and all crops are expected to respond to applications of nitrogen and phosphorus fertilizers. The soils are not suited to root crops.

Agronomic group 2

This group consists of soils high in lime content that are well to imperfectly drained and loam to silty clay in texture. It is divided into two sub-groups on the basis of type of parent material and stoniness.

Sub-group 2A—High-lime, lacustrine soils.

Fisher series	Ledwyn series
Hodgson series	Morton complex
Lakeland series	Plum Ridge series

These are moderately good agricultural soils that have no major management problems but contain excessive amounts of lime carbonate at or near the surface. While the surface horizons of some virgin soils are free of lime, the soils are thin and cultivation tends to mix the surface layers with the limy material below. These soils are low in available phosphorus and organic matter and all crops will likely respond to phosphate and nitrogen fertilizers. The soils are susceptible to wind erosion and loss of the top soil results in greatly lowered productivity. Grain, forage and root crops will grow well on these soils if adequately fertilized.

*Agronomic Soil Groups as used here are not part of a classification scheme but simply a grouping of soils with closely related management problems and productivity.

TABLE 28

Estimated Suitability of Soils in the Fisher and Teulon Map Areas for Various Purposes

RATING SYMBOLS: E = excellent; E-G = excellent to good; G-E = good to excellent; G = good; G-F = good to fair; F-G = fair to good; F = fair; F-P = fair to poor; P-F = poor to fair; P = poor; VP = very poor; V = variable; X = not naturally favourable, but could be used if suitable corrective measures were adopted; ++ = well adapted; +− = more or less suitable; −− = not suitable or of relatively low value.

NOTE: The following estimates are given as a guide to the average suitability of each soil for land-use in average seasons.

Soil Name	CULTIVATED LAND									UNBROKEN LAND				
	Grain Crops			Intertilled Crops			Cultivated Hay and Pasture Crops		Gardens and Fruits					
	Wheat	Oats	Barley	Fodder Corn	Seed Corn	Roots and Potatoes	Grasses	Legumes		Native Hay	Grazing	Wild Life	Forestry	Field Windbreaks
Agassiz series	−−	−−	−−	−−	−−	−−	P	P	−−	P	P-F	+−	−−	−−
Alluvium (Undifferentiated)	−−	−−	−−	−−	−−	−−	−−	−−	−−	V	V	+−	−−	−−
Arborg series	G-F	G-F	F	F-P	F-P	F-P	G	G	G-F	−−	P	−−	+−	+−
Arnes series	G-E	G-E	G- E	G	F	G-F	G	G-E	G-F	−−	P	+−	++	++
Balmoral series	(X)F-G	(X)F-G	(X)F	−−	−−	(X)F	(X)G	(X)G-F	(X)F	F-G	F-G	−−	−−	+−
Berlo series	F-P	F	F-P	F-P	F-P	F	F-G	F	F	F-G	F-G	−−	−−	+−
Chatfield complex	−−	−−	−−	−−	−−	−−	−−	−−	−−	P	P	+−	−−	−−
Clarkleigh series	P	P	P	−−	−−	−−	F	F	P	F	F	−−	−−	−−
Deep Peat	−−	−−	−−	−−	−−	−−	−−	−−	−−	X	X	+−	+−	−−
Fisher series	G-F	G-F	F	G-F	−−	G-F	G-E	G-E	G	−−	G-F	−−	−−	+−
Foley series	(X)F-G	(X)F-G	(X)F	(X)F	(X)F-P	(X)F	(X)G	(X)G	(X)F	G-F	G-F	−−	−−	+−
Framnes series	G	G	G-F	F	−−	F	G-E	G-E	G-F	−−	P	−−	++	++
Fyala series	(X)F-G	(X)F-G	(X)F	−−	−−	−−	(X)G	(X)F-G	(X)F	G	G	+−	+−	+−
Garson series	F	F	F	P-F	P-F	P-F	F-G	G-F	F	−−	P-F	+−	+−	+−
Hodgson series	G	G	G	G-F	F	G-F	G	G-E	G	F	G-F	−−	++	++
Inwood series	F	F	F	−−	−−	F	F-G	G-F	F	−−	F	+−	+−	+−
Isafold series	F	F	F	F-P	−−	F	F-G	G-F	F	−−	F	+−	−−	−−
Lakeland series	G	G	G	F-G	−−	G-F	G	G-E	G-F	F-G	F	−−	−−	+−
Leary complex	−−	−−	−−	−−	−−	−−	P	P	−−	P	P	+−	+−	−−
Ledwyn series	G-F	G-F	G-F	−−	−−	F	G-E	G-E	G	−−	F	−−	−−	+−
Lundar series	F	F	F	−−	−−	F-P	F	F-G	F-P	G-F	G-F	+−	−−	−−
Malonton series	(X)F-P	(X)F	(X)F-P	−−	−−	(X)F-P	(X)F-G	(X)F-P	(X)F	F	F	+−	−−	−−
Marsh complex	−−	−−	−−	−−	−−	−−	−−	−−	−−	F-P	F-P	++	−−	−−
Meleb series	(X)F	(X)F	(X)P-F	−−	−−	−−	F	−−	(X)F	F	F-G	+−	−−	−−
Morton complex	(V)G-F	(V)G-F	(V)G-F	F	F	F-G	G-E	G-E	(V)G-F	−−	F	−−	++	++
Narcisse series	P	P	P	−−	−−	−−	−−	−−	F-P	F-P	F	++	−−	−−
Osborne series	(X)F-G	(X)F-G	(X)F	−−	−−	(X)F-P	(X)G	(X)F-G	(X)F	G	G	−−	−−	+−
Peguis series	G	G	G-F	F	−−	F	G-E	G	G	−−	F-G	−−	++	++
Pine Ridge series	P	P	P	P-F	P-F	F-P	F	F-G	F	−−	F	−−	+−	+−
Plum Ridge series	G-F	G-F	G-F	F	−−	G-F	G-E	G-E	G-E	G-F	G	−−	−−	+−
Polson complex	−−	−−	−−	−−	−−	−−	−−	−−	−−	F	F	+−	−−	−−
Red River series	G	G	G-F	F	−−	F	G-E	G	G	G	G	−−	−−	+−
Rock	−−	−−	−−	−−	−−	−−	−−	−−	−−	−−	P	++	−−	−−
Saline Flats	−−	−−	−−	−−	−−	−−	−−	−−	−−	−−	VP	+−	−−	−−
Sand Beaches	−−	−−	−−	−−	−−	−−	−−	−−	−−	−−	−−	+−	−−	−−
Shallow Peat	(X)P	(X)P	(X)P	−−	−−	−−	(X)F-G	−−	−−	P	P	+−	+−	+−
Shorncliffe series	G	G	G-F	F	−−	F	G-E	G-E	G	−−	F-G	−−	+−	+−
Stonewall complex	F	F	F	P-F	P-F	P-F	F-G	G-F	F	−−	F	+−	+−	+−
Tarno series	(X)F-G	(X)F-G	(X)F	−−	−−	(X)F-P	(X)G	(X)F-G	(X)F	G	G	−−	−−	+−

Sub-group 2B—Stony, high-lime, till soils.

Garson series
Inwood series
Isafold series
Lundar series
Narcisse series
Stonewall series

Agricultural utilization of these soils is severely hampered by excessive stoniness. Cultivation requires intensive stone removal, and most of the land is unbroken. Cultivated soils are moderately productive but require phosphate and nitrogen fertilization. Legume crops, particularly alfalfa for hay and seed, produce well on these calcareous soils. Most virgin soils are used as native pasture land, but the carrying capacity is severely restricted by the scrub aspen vegetation that covers most areas. Removal of the tree and shrub cover and seeding of suitable grasses would greatly increase the hay and pasture value of this land.

Agronomic group 3

This group consists of dry sandy and gravelly soils.

Agassiz series
Leary complex
Pine Ridge series

The low fertility and low water holding capacity of these coarse textured soils limits their agricultural value. They are not suited to grain production and are best used for native or improved pasture land. If grasses are sown on these soils, drouth-tolerant species should be selected.

Agronomic group 4

This group consists of sandy soils that are intermittently wet.

Berlo series

These soils are low in natural fertility and low in water holding capacity but their agricultural value is enhanced by a high water table that keeps the sub-soil moist in most seasons. They are best suited to forage crop production and will respond favorably to nitrogen and phosphate fertilization in most years. Wind erosion, a serious problem on bare fields, can be minimized by a trash cover and by periodic seeding down of grass-legume crops.

Agronomic group 5

This group consists of poorly drained soils. It is divided into four sub-groups on the basis of texture, lime content, stoniness and degree of wetness.

Sub-group 5A—Poorly drained clay soils.

Fyala series
Osborne series

These soils are non-arable unless drainage is improved by the installation of ditches. Most areas have received some drainage improvement and are being cultivated. They are moderately fertile soils but are subject to water-logging and local flooding during wet spring seasons and after heavy summer rains. For this reason, grain production is hazardous with frequent crop losses or greatly reduced yields. They are best suited for hay production if water-tolerant grasses are selected. Deep-rooted legume crops will improve internal drainage in areas where adequate surface drainage can be provided. Nitrogen and phosphorus fertilizers are recommended for grain and forage crops.

Sub-group 5B—Poorly drained, high-lime soils on lacustrine deposits.

Balmoral series
Foley series
Tarno series

In addition to the need for artificial drainage, these soils are further reduced in agricultural value by a high lime content in the surface and subsoil layers. Soil salinity also is common in many areas. Cultivated soils are subject to excessive wetness for prolonged periods in the spring and after heavy summer rains. The soils are low in available phosphorus and nitrogen and fertilizers are recommended, particularly for grain crops. Grain production is risky and crop losses are frequent. Unless the drainage system is adequate to provide protection from prolonged flooding or water-logging the land should be used for forage production.

Sub-group 5C—Poorly drained, high-lime, stony soils on till deposits.

Clarkleigh series
Meleb series

These soils are not suitable for cultivation. They are wet during most of the year, very high in lime content, variably stony, and some areas are highly saline. Most areas of these soils are used as native pasture land. Their value for this purpose varies with the vegetative cover, salinity and degree of wetness. The Clarkleigh soils have less bush cover, but many areas are saline and the natural forage is of low quality. Some areas of Meleb have been cultivated, but the flooding hazard is high and cultivation is not possible in many years. These areas are best suited for use as improved pasture land.

Sub-group 5D—Poorly drained sandy and gravelly soils.

Malonton series
Polson complex

These soils are not suitable for cultivation. They occur in depressional areas and the water table is at or near the surface for most of the summer season. They have only a limited use as native pasture land.

Agronomic Group 6

This group consists of peaty and mucky soils.

Chatfield complex Marsh
Deep peat Shallow peat, drained phase

In their natural condition, these soils are nonarable and of very limited value as hay or pasture land. They are saturated or flooded with water for most of the summer and the native vegetation is dominantly reeds and sedges. Shallow Peat soils are being cultivated in a few areas where drainage has been improved through the installation of open ditches. These drained organic soils are low in fertility and subject to extremes in moisture conditions. They are better suited to grass production than to grain crops.

C. HISTORY OF SETTLEMENT*

The history of land settlement in the Interlake district of Manitoba can be divided into three periods: prior to 1900, or before the influx of large numbers of immigrants from Central and Eastern Europe; 1900 to 1930 when most of the farm land in the district was settled through homesteading and pre-emption; and after 1930 when the land resources of Manitoba were transferred from the Federal to the Provincial Government and the homesteading policy was discontinued.

Prior to 1900 most of the settlement in the Interlake district was in the southern portion, represented by the present municipalities of St. Laurent, Woodlands and Rockwood, and in the "Icelandic Reserve" along the shore of Lake Winnipeg. In St. Laurent municipality the early settlers were Metis who acquired the land through Half-Breed Script—titles to 240 acre parcels of land were issued by the Federal Government to Metis who were living in Manitoba prior to the land survey. In Woodlands and Rockwood municipalities 60 to 70 percent of the land had been occupied by 1900. Disposal of this land was through homesteading, sales, Half-Breed Script, military bounty grants and soldier grants. The Icelandic Reserve was a strip of land bordering Lake Winnipeg from Boundary Creek to the top of Township 24 and extending inland to the eastern boundary of Range 2 east. It also included Black Island and other islands bordering the mainland. Settlement rights on even numbered sections in this area were granted to Icelandic immigrants in 1875. Later in 1885, the odd numbered sections were opened for homesteading and pre-emption privileges were given to the Icelanders for two years, but this was extended from time to time until 1898. This area is now in the municipalities of Gimli and Bifrost and remains as a strongly Icelandic community.

The 1901 Census of Canada reports a total population in the Interlake district (Census Division 12) of about 5,000 people. By 1921 the population had risen to a peak of over 28,000, from which it has declined slightly in more recent years. This rapid growth in population between 1901 and 1921 was the result of land settlement through homesteading and sales throughout all of the district and soldier settlement following the First World War in the municipalities of St. Laurent, Coldwell, Armstrong, Eriksdale, Siglunes, Grahamdale and Fisher. During the same period the railways acquired tracts of land in Woodlands, Rockwood and Armstrong municipalities.

Since 1930 all land disposal has been by sales. New settlement in recent years has been almost entirely in the local government district of Fisher, where a large tract of poorly drained, peaty land has been reclaimed through the installation of a network of drainage ditches. Most of the municipalities in the Interlake district have experienced a decrease in farm population and land held in farms during this period. Many of the small farms on the poorer soils have proven unprofitable and have been abandoned or taken into larger units and used as ranch land.

D. AREA AND PRESENT USE OF FARM LAND

The area and present use of farm land in the Fisher and Teulon map areas are indicated in the figures contained in the Census of Canada and in Provincial Municipal Records.

The farm land in percent of total municipal acreage and the number of farms, acres in farms and average size of farms in each municipality are given in Table 29. In the areas of better agricultural soils, included in the municipalities of Gimli, Bifrost and Rockwood, most of the land is held as farms and these are small in size. In the rest of the Interlake district, little more than one half of the land is held as farms and the average land holdings are larger. During the period of 1941 to 1956 there was a decrease in the number of farms and an increase

*Acknowledgment is made to Prof. J. H. Ellis, Agricultural Consultant with the Lands Branch, Manitoba Department of Mines and Natural Resources for the information contained in this section.

in their average size in all areas except St. Laurent municipality where there was a slight increase in the number of farms.

The utilization of farm land in each municipality and local government district is given in Table 30. In the municipalities containing the better agricultural lands (Gimli, Bifrost, Rockwood and Woodlands) 40 to 60 percent of the farm land has been cultivated and barley, oats and wheat are the major crops. In the municipalities and local government districts within the Garson soil association area (Eriksdale, Siglunes, Grahamdale, Armstrong and Fisher) only 15 to 40 percent of the farm land has been cultivated and there is a high percentage of bushland on most farms. In St. Laurent and Coldwell municipalities, which lie within the Isafold soil association area, ranching is the dominant farm enterprise and less than 10 percent of the farm land has been cultivated.

The average yields of field crops in the Interlake district over the 21 year period of 1939 to 1959 are given in Table 31. In considering these yields it must be remembered that most of the field crops are grown on the best soils in the district and that large areas of poorer soils are not used for grain production.

The average numbers of livestock per farm in each municipality and local government district are given in Table 32. Livestock are well distributed throughout the Interlake district. Cattle are more numerous in the western portion (St. Laurent, Woodlands, Coldwell, Eriksdale, Siglunes and Armstrong L.G.D.) where ranching and dairying are the major enterprises on a large portion of the farms. Small flocks of sheep are kept by some farmers throughout the map areas. Swine are raised in small numbers on most farms and form major enterprises on others, particularly in Rockwood and Woodlands municipalities. Poultry are most numerous in the grain farming portion of the area, as represented by Bifrost, Rockwood and Woodlands municipalities.

TABLE 29

Number, Area and Average Size of Farms by Municipalities, Canada Census Data, 1956

Municipalities	Farm Land in Percent of Total	Number of Farms	Acres in Farms	Average Size of Farms
Gimli	81.8	308	59,651	193.7
Bifrost	98.3	688	140,709	204.5
St. Laurent	55.8	125	60,996	488.0
Woodlands	73.4	428	197,784	462.1
Coldwell	68.0	263	138,261	525.7
Rockwood	83.1	925	237,753	257.0
Eriksdale	51.9	231	95,024	411.3
Siglunes and part of Grahamdale (L.G.D.)	59.3	360	166,591	462.7
Armstrong (L.G.D.) and part of Fisher (L.G.D.)	52.1	1,970	504,193	255.9

TABLE 30

Utilization of Farm Land Expressed as Percent of Acreage Held as Farms, Canada Census Data, 1956

Municipalities	Acreage in Farms	Fallow	Wheat	Oats	Barley	Rye	Flax	Mixed Grains	Hoed Crops	Seeded Hay and Pasture	Other Crops	Native Pasture	Woodland
Gimli	59,651	6.9	7.8	5.5	6.0	....	2.8	0.4	0.1	11.3	2.3	43.7	13.2
Bifrost	140,709	7.2	12.0	9.3	13.6	....	3.6	0.8	....	12.0	5.3	24.2	12.0
St. Laurent	60,996	0.2	....	0.6	....	....	....	....	0.1	0.3	0.7	78.3	19.7
Woodlands	197,784	7.8	5.4	10.2	10.0	0.1	2.2	0.7	....	5.5	4.4	46.4	7.3
Coldwell	138,261	1.4	0.3	2.2	0.6	....	....	0.1	....	3.4	0.8	64.8	26.4
Rockwood	237,753	12.5	8.7	15.4	8.5	....	2.0	1.3	0.1	8.8	6.3	29.4	7.0
Eriksdale	95,024	3.8	0.5	5.2	0.9	0.1	0.4	....	....	2.8	3.8	46.1	36.4
Siglunes and part of Grahamdale (L.G.D.)	166,591	4.1	1.4	2.7	0.9	....	0.5	0.2	....	5.5	1.8	43.3	39.6
Armstrong (L.G.D.) and part of Fisher (L.G.D.)	504,193	6.4	8.0	7.8	3.8	....	1.4	0.1	0.1	8.7	2.7	40.4	20.6

TABLE 31

Average Yields of Field Crops in Manitoba Crop Reporting District No. 12 (Mid-Lake) 1939 to 1959*

Year	Wheat Bus./acre	Oats Bus./acre	Barley Bus./acre	Fall Rye** Bus./acre	Spring Rye Bus./acre	Flax Bus./acre	Potatoes Cwt./acre
1939	26.0	30.2	26.6	14.7	17.6	9.5	65
1940	13.9	17.2	12.5	5.2	4.6	6.5	27
1941	19.5	32.8	26.1	15.9	15.0	7.7	100
1942	28.8	50.0	37.0	20.0	20.0	12.0	81
1943	26.0	37.0	28.5	16.0	15.0	12.0	80
1944	27.0	41.0	33.0	17.0	15.0	13.0	55
1945	22.3	36.7	27.7	20.0	....	11.0	70
1946	22.5	36.0	24.0	19.0	19.0	9.0	55
1947	16.6	28.5	18.7	18.0	....	10.0	63
1948	25.9	42.7	32.4	19.7	15.7	10.6	67
1949	17.7	32.6	25.0	....	....	10.7	70
1950	23.7	46.0	36.0	15.0	....	9.0	70
1951	25.0	40.9	27.6	19.3	....	9.5	136
1952	24.1	43.4	33.1	20.0	19.0	10.0	141
1953	22.7	32.0	23.7	....	16.0	9.6	170
1954	11.5	22.6	18.0	14.0	....	7.9	94
1955	15.5	20.7	13.3	12.5	....	8.2	100
1956	29.1	51.7	32.5	17.3	....	11.4	14
1957	20.9	36.5	17.9	14.5	....	5.7	80
1958	21.5	35.9	25.6	17.5	....	8.0	117
1959	21.1	39.9	24.8	15.5	....	11.9	96
Average Yield	21.9	35.9	25.9	16.4	15.7	9.7	83

*Report on crops, livestock, etc., Manitoba Department of Agriculture and Conservation, 1939 to 1959.
**Includes Spring Rye after 1953.

TABLE 32

Average Numbers of Livestock per Farm Canada Census Data, 1956

Municipalities	Horses	Cattle		Sheep	Swine	Poultry	
		Milk Cows	Other Cattle			Hens and Pullets	Other Poultry
Gimli	1.0	5.5	6.7	2.4	1.4	23.7	33.2
Bifrost	0.7	5.0	7.9	3.9	1.9	41.2	56.4
St. Laurent	3.0	9.4	26.3	2.6	1.2	15.9	13.4
Woodlands	1.7	7.3	18.4	1.9	6.4	51.0	91.0
Coldwell	2.6	11.6	30.0	5.3	2.0	16.0	15.0
Rockwood	1.2	7.0	8.8	1.6	7.1	36.6	61.1
Eriksdale	2.0	7.0	19.1	4.0	2.6	30.6	29.6
Siglunes and part of Grahamdale (L.G.D.)	2.3	8.9	27.7	5.7	1.7	18.4	15.4
Armstrong (L.G.D.) and part of Fisher (L.G.D.)	1.5	6.1	11.2	1.5	2.0	22.0	34.3

Glenn A. Kreutzer

SOIL MAP

DETAILED RECONNAISSANCE SURVEY OF FISHER AREA IN MANITOBA

Scale — 1:100,000

Miles 2 0 2 4 6 8 10 12 Miles

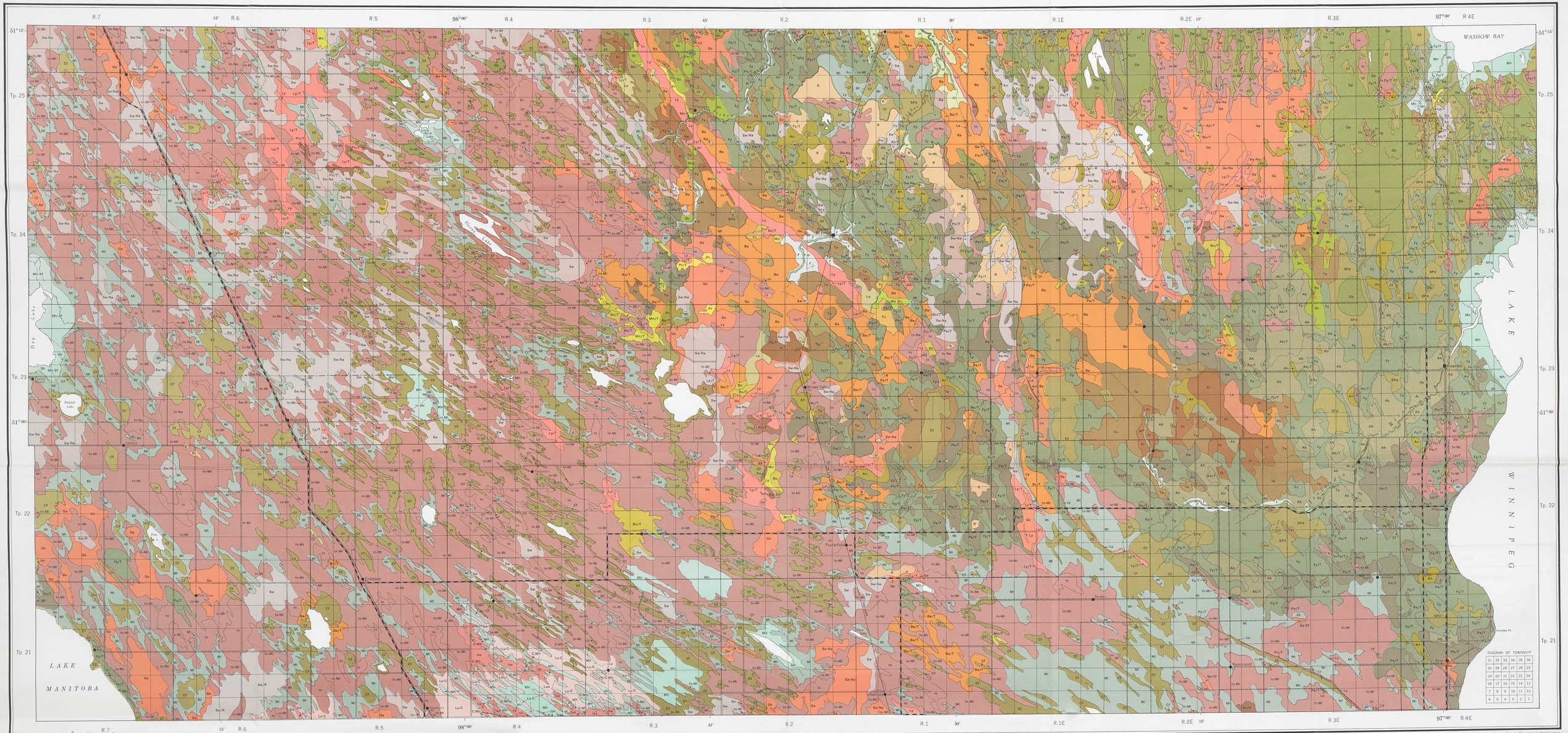


DIAGRAM OF TOWNSHIP

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

Glenn A Kreutzer

Soils information supplied by the Manitoba Soil Survey, Research Branch, Canada Department of Agriculture; Manitoba Department of Agriculture and Conservation; Lands Branch, Manitoba Department of Mines and Natural Resources; and Department of Soil Science, The University of Manitoba.

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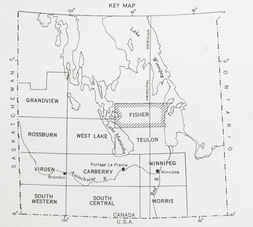
REFERENCE

Soil Boundary
Parish and Settlement Boundary
Township and Range lines
Section and Lot lines
Trunk Highway
Secondary Highway
Escarpment
Railway
Town and Village
River and Stream
Intermittent Stream
Ditch
Gravel Pit or Mine
Elevation
Fence

KEY MAP



LEGEND

MAP SYMBOL AND COLOR	SOIL NAME AND DOMINANT SURFACE TEXTURE	PROFILE TYPE	PARENT MATERIAL	NATURAL DRAINAGE	DOMINANT NATIVE VEGETATION	TOPOGRAPHY	STONINESS
Al	ALLUVIUM (undifferentiated)	Orthic Regosol	Strongly calcareous, coarse to fine, recent alluvial deposits	Poor to moderately good	Aspen, black poplar, willow and alder	Depressional to gently sloping	Stone-free
Ab	ARBORG SERIES (clay)	Grey Wooded Solodized Solonetz	Weakly to moderately calcareous lacustrine clay	Imperfect	Aspen and spruce	Level	Stone-free
Ab/T	ARBORG till substrate phase (clay)	Grey Wooded Solodized Solonetz	6-30" of above sediments over calcareous till	Imperfect	Aspen and spruce	Level to very gently sloping	Slightly stony
An	ARNES SERIES (clay)	Dark Grey Wooded	6-30" of lacustrine clay over strongly calcareous till	Moderately good	Aspen and spruce	Level to irregular very gently sloping	Slightly to moderately stony
An/R	ARNES rock substrate phase (clay)	Dark Grey Wooded	Less than 30" of above sediments over limestone bedrock	Moderately good	Prairie grasses, scattered jack pine	Level to very gently sloping	Slightly to moderately stony
Ba	BALMORAL SERIES (silty clay loam)	Peaty Calcareous Meadow	Strongly calcareous; moderately fine to fine deltaic sediments	Poor	Meadow grasses, sedges and herbs	Depressional to level	Stone-free
Ba/T	BALMORAL till substrate phase (silty clay loam)	Peaty Calcareous Meadow	6-30" of above sediments over strongly calcareous till	Poor	Meadow grasses, sedges and herbs	Depressional to level	Slightly stony
Bo	BERLO SERIES (fine sand)	Gleyed Dark Grey Wooded	Moderately calcareous sandy deltaic sediments	Imperfect	Aspen, black poplar and willow	Level to very gently sloping	Stone-free
Bo/T	BERLO till substrate phase (fine sand)	Gleyed Dark Grey Wooded	6-30" of above sediments over strongly calcareous till	Imperfect	Aspen, black poplar and willow	Irregular, very gently to gently sloping	Slightly to moderately stony
Cf	CHATFIELD COMPLEX (peat)	Organic soil and Peaty Meadow	6-36" of fen peat over undifferentiated materials	Very poor	Reeds and sedges	Depressional	Stone-free to slightly stony
C	CLARKLEIGH SERIES (silty clay loam)	Calcareous Meadow	4-15" of silty sediments over strongly calcareous till	Poor	Sedges, salt tolerant plants and willow	Depressional to level	Moderately to very stony
C — Mh	CLARKLEIGH-MARSH COMPLEX	Calcareous Meadow; Saline Meadow and Calcareous Gleysol	Thin silty lacustrine mantle over strongly calcareous till	Poor to very poor	Sedges, reeds, and salt tolerant plants	Level with low ridge and swale micro-relief	Slightly to very stony
Dp	DEEP PEAT	Organic soil	Peat deposits over 36" thick	Very poor	Reeds, sedges, black spruce and tamarack	Depressional	Stone-free
F	FISHER SERIES (silty clay loam)	Mull Regosol	Strongly calcareous, moderately fine to fine alluvial deposits	Imperfect	Aspen and black poplar	Smooth, very gently to gently sloping	Stone-free
Fo	FOLEY SERIES (very fine sandy loam)	Peaty Calcareous Meadow	Strongly calcareous, medium to moderately coarse deposits	Poor	Meadow grasses and willow	Depressional to level	Stone-free
Fr	FRAMNES SERIES (clay)	Gleyed Dark Grey	Thin clay deposit over strongly calcareous silty deposits	Imperfect	Aspen and spruce	Level	Stone-free
Fy	FYALA SERIES (clay)	Peaty Meadow	Weakly to moderately calcareous lacustrine clay	Poor	Meadow grasses, spruce, black poplar and willow	Depressional to level	Stone-free
Fy/T	FYALA till substrate phase (clay)	Peaty Meadow	6-30" of above sediments over strongly calcareous till	Poor	Meadow grasses, spruce, black poplar and willow	Depressional to level	Slightly stony
Ga	GARSON SERIES (sandy loam)	Orthic Grey Wooded	Strongly calcareous till	Moderately good to good	Aspen, some burr oak and white spruce	Irregular,very gently to gently sloping	Very to excessively stony
Ga-Cf	GARSON-CHATFIELD COMPLEX	Orthic Grey Wooded, Shallow Peat and Peaty Meadow	Strongly calcareous till and thin peat deposits over till	Good and very poor	Aspen, spruce, reeds, sedges and willow	Irregular, gently sloping with sharp depressions	Mostly very stony
Ga-Na	GARSON-NARCISSE COMPLEX	Orthic Grey Wooded and Orthic Black	Strongly calcareous till and thin stratified drift over rock	Moderately good to good	Spruce and spear grass — potentilla prairie	Level to irregular, very gently sloping	Moderately to very stony
Ga/R	GARSON rock substrate phase (Sandy loam)	Orthic Grey Wooded	Thin deposits of strongly calcareous till over limestone bedrock	Moderately good to good	Spruce	Irregular, very gently sloping	Excessively stony
H	HODGSON SERIES (very fine sandy clay loam)	Mull Regosol	Strongly calcareous, medium to moderately fine alluvial deposits	Moderately good	Aspen and spruce	Smooth, gently sloping	Stone-free
In	INWOOD SERIES (fine sandy clay loam)	Gleyed Dark Grey	Strongly calcareous till	Imperfect	Aspen, some burr oak, spruce and willow	Level to irregular, very gently sloping	Moderately to very stony
In — Mi	INWOOD-MELEB COMPLEX	Gleyed Dark Grey and Peaty Calcareous Meadow	Strongly calcareous till	Imperfect to poor	Aspen, black poplar, spruce and willow	Irregular, gently sloping (ridge and swale)	Moderately to very stony
In — Na	INWOOD-NARCISSE COMPLEX	Gleyed Dark Grey and Orthic Black	Strongly calcareous till and thin stratified drift over limestone bedrock	Imperfect to good	Aspen and spear grass — potentilla prairie	Level to irregular, very gently sloping	Moderately to very stony
In-Fy/T	INWOOD-FYALA TILL SUBSTRATE COMPLEX	Gleyed Dark Grey and Peaty Meadow	Strongly calcareous till and thin clay deposits over till	Imperfect to poor	Aspen, black poplar and black spruce	Irregular, gently sloping (ridge and swale)	Very to slightly stony
Is	ISAFOLD SERIES (clay loam)	Rego Black	Strongly calcareous till	Moderately good to good	Aspen, burr oak, hazel, prairie grasses	Level to irregular, gently sloping	Very stony
Isx	ISAFOLD-LUNDAR-CLARKLEIGH COMPLEX	Rego Black, Gleyed Rego Black Calcareous and Saline Meadow	Strongly calcareous till and thin clay deposits over till	Good to poor	Aspen, burr oak, sedges and meadow grasses	Irregular, gently sloping (ridge and swale)	Moderate to very stony
La	LAKELAND SERIES (clay loam)	Gleyed Rego Black	Strongly calcareous, fine to moderately fine sediments	Imperfect	Meadow-prairie grasses and herbs, aspen	Level	Stone-free
La/T	LAKELAND till substrate phase (clay loam)	Gleyed Rego Black	6-30" of above sediments over strongly calcareous till	Imperfect	Meadow-prairie grasses and herbs, aspen	Level to very gently sloping	Slightly stony
Ly	LEARY COMPLEX (loamy sand)	Dark Grey and Dark Grey Wooded	Sand and gravel outwash and beach deposits	Good to somewhat excessive	Prairie grasses, aspen, burr oak and spruce	Smooth, very gently to gently sloping	Cobbly but usually boulder-free
Ly/T	LEARY till substrate phase (loamy sand)	Dark Grey and Dark Grey Wooded	6-30" of above sediments over strongly calcareous till	Moderately good to good	Aspen, burr oak, spruce and prairie grasses	Irregular, very gently to gently sloping	Slightly stony
Le	LEDWYN SERIES (very fine sandy clay loam)	Gleyed Dark Grey	Strongly calcareous, medium to moderately fine sediments	Imperfect	Aspen and spruce	Level to very gently sloping	Stone-free
Lu	LUNDAR SERIES (clay loam)	Gleyed Rego Black	Strongly calcareous till	Imperfect	Aspen, meadow-prairie grasses, willows, oak	Level to irregular, gently sloping	Moderately to very stony
Lu-C	LUNDAR-CLARKLEIGH COMPLEX	Gleyed Rego Black, Calcareous and Saline Meadow	Strongly calcareous till and thin silty deposits over till	Imperfect to poor	Meadow and meadow-prairie grasses, aspen	Irregular, very gently sloping (ridge and swale)	Moderately to very stony
Lux	LUNDAR-CLARKLEIGH-MARSH COMPLEX	Gleyed Rego Black, Calcareous and Saline Meadow, Calcareous Gleysol	Strongly calcareous till and thin silty deposits over till	Imperfect to very poor	Meadow grasses, sedges, reeds and some aspen	Irregular, very gently to gently sloping	Slightly to very stony
Mn	MALONTON SERIES (sandy loam)	Peaty Calcareous Meadow	Moderately calcareous, coarse to moderately coarse sediments	Poor	Meadow grasses, sedges, willow and black poplar	Depressional to level	Stone-free
Mn/T	MALONTON till substrate phase (sandy loam)	Peaty Calcareous Meadow	6-30" of above sediments over strongly calcareous till	Poor	Meadow grasses, sedges, willow and black poplar	Depressional to level	Slightly stony
Mh	MARSH COMPLEX (mucky silty clay)	Calcareous Gleysol	Thin muck and silty deposits over strongly calcareous till	Very poor	Slough grasses, reeds and sedges	Depressional	Slightly to moderately stony
Mh — Sf	MARSH-SALINE FLATS COMPLEX	Calcareous Gleysol and Saline Rego Gleysol	Strongly calcareous till and thin silty deposits over till	Very poor	Reeds, sedges and salt tolerant plants	Depressional to level	Slightly to very stony
Ml	MELEB SERIES (clay loam)	Peaty Calcareous Meadow	Strongly calcareous till	Poor	Meadow grasses, sedges, willow and aspen	Depressional to level	Moderately to very stony
Mo	MORTON COMPLEX (fine sandy clay loam)	Dark Grey Wooded and Orthic Grey Wooded	Strongly calcareous, moderately coarse to moderately fine sediments	Moderately good to good	Aspen, some burr oak and elm	Level to very gently sloping	Stone-free
Na	NARCISSE SERIES (sandy loam)	Orthic Black	6-30" of coarse stratified drift over limestone bedrock	Good at surface but impeded below	Spear grass-Potentilla prairie, stunted aspen	Level to irregular, very gently sloping	Very stony
Pe	PEGUIS SERIES (clay)	Gleyed Dark Grey	Weakly to moderately calcareous lacustrine clay	Imperfect	Aspen, some white spruce	Level	Stone-free
Pe/T	PEGUIS till substrate phase (clay)	Gleyed Dark Grey	6-30" of above sediments over calcareous till	Imperfect	Aspen, some white spruce	Level	Slightly stony
Py	PINE RIDGE SERIES (loamy fine sand)	Orthic Grey Wooded	Moderately calcareous, sandy deltaic and beach deposits	Moderately good to good	Aspen, some white spruce	Level to smooth, gently sloping	Stone-free
Py/T	PINE RIDGE till substrate phase (loamy fine sand)	Orthic Grey Wooded	6-30" of above sediments over strongly calcareous till	Moderately good to good	Aspen, some white spruce	Level to irregular, gently sloping	Slightly stony
Po	POLSON COMPLEX, (fine sandy loam to silty clay)	Peaty Meadow and Gleyed Rego Black	Thin layer of moderately coarse to fine sediments over gravel	Poor to imperfect	Meadow grasses and herbs, willow and black poplar	Depressional to level	Dobbly but usually boulder free
Po/T	POLSON till substrate phase (fine sandy loam to silty clay)	Peaty Meadow	6-30" of above sediments over strongly calcareous till	Poor	Meadow grasses and herbs, willow and black poplar	Depressional to level	Slightly stony
R	ROCK	Regosol	Less than 6" of regolith over limestone bedrock		Sparse prairie grasses and some jack pine	Level to very gently sloping	
Sf	SALINE FLATS	Saline Rego Gleysol	Strong crusts of salt tolerant plants	Very poor	Sparse growth of salt tolerant plants	Level	Moderately to very stony
Sb	SAND BEACHES	Regosol	Recent sandy beach deposits	Varies with lake level	Some aspen and willow	Gently sloping to lake	Stone-free to very bouldery
Sh	SHORNCLIFFE SERIES (clay)	Gleyed Dark Grey Wooded	Thin deposit of clay over strongly calcareous silty deposits	Imperfect	Aspen and spruce, some willow and hazel	Level	Stone-free
SPd	SHALLOW PEAT (drained phase)	Organic Soil	12-36" of peat over undifferentiated deposits	Very poor	Reeds and sedges	Depressional	Stone-free
Sw	STONEWALL COMPLEX (clay loam)	Dark Grey Wooded and Dark Grey	Strongly calcareous till	Moderately good to good	Aspen, burr oak and spruce	Irregular, very gently to gently sloping	Very stony to excessively stony
Sw-Na	STONEWALL-NARCISSE COMPLEX	Dark Grey Wooded and Orthic Black	Strongly calcareous till and thin stratified drift over limestone bedrock	Moderately good to good	Aspen, spruce, prairie grasses and herbs	Level to irregular, very gently sloping	Very stony to excessively stony
Sw/R	STONEWALL rock substrate phase	Dark Grey Wooded and Dark Grey	Thin deposit of strongly calcareous till over limestone bedrock	Moderately good to good	Aspen	Irregular, very gently sloping	Excessively stony
Ta	TARNO SERIES (clay)	Peaty Meadow	Thin clay deposit over strongly calcareous silty deposits	Poor	Meadow grasses, sedges, willow and poplar	Depressional to level	Stone-free